

World's Columbian Exposition of 1893 at Chicago, U. S. A.




R U S S I A.

WAR DEPARTMENT.

SKETCH OF THE ARTICLES
exposed by the War Department
at the
WORLD'S COLUMBIAN EXPOSITION
of 1893 at Chicago.



S T. - P E T E R S B U R G.
Military Typography (in the building of the General Staff).
1893.



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For determining a system for the participation of the War Department at the World's Columbian Exposition of 1893 at Chicago and for carrying it into execution, there was formed, by order of the Minister of War, a special Committee presided over by the Privy Councilor *Verkhovtsov*, Regular Member and Superintendent of the Technical Committee of the Chief Intendancy Department.

The above Committee consisted of the following persons, detached by the Chief Departments participating in the Chicago Exposition: a) Artillery — Regular Member of the Artillery Committee, Lieutenant-Colonel *Jakimovitch*; b) Engineer — Secretary of the Engineer Committee, Major-General *Bronish*; c) Military-Educational Institutions — Director of the Pedagogic Museum, Major-General *Makarof*; and d) Military - Medical — Permanent Member of the Military-Medical Scientific Committee, Actual Councilor of State *Freden*. The duties in the preparation of the articles exposed by the Intendancy Department and those of secretary of the Committee were fulfilled by the Aulic Councilor *Andreef*, functionary of the Chief Intendancy Department.

The following persons are attached to the section of the Ministry of War at the Chicago International Exposition: a) as Commissary of the War Department—Assistant Inspector of the classes of the I-st Moscow Corps of Cadets, Councilor of State *Gerd*; and b) as Assistant-Commissaries: for the first half term of the Exposition — functionary of the Chief Intendancy Department, Engineer-Technologist, Aulic Councilor *Andreef*, and for the second half term—Chief of the work-shop of the St. Petersburg local artillery arsenal, Captain *Gedeonof*.



RUSSIA.

WAR DEPARTMENT.

Sketch of the articles exposed.

The War Department participates in the World's Columbian Exposition with artillery, engineering, intendancy, military-educational and military-medical articles.

The Ministry of War, in the general composition of government administration, is the highest organ through which Imperial army-orders are promulgated and executed. This Department, being administered by the Minister of War, consists of a Council, a Chancellery, and of Chief Administrations.

The description of the articles, exposed by the War Department, is given successively in the order of their appurtenance to the Chief Administrations of said Ministry and are, therefore, thus classified: 1) Articles belonging to artillery, 2) to engineering, 3) to the intendancy, 4) to the Military-educational section and 5) to the Military-Medical section.

In mentioning the institutions exposing their articles, we consider it necessary to give an approximately complete description of them as well as of the articles worthy of a special attention or requiring an explanation as to their meaning and construction.

A) Artillery.

The affairs of this branch are concentrated in the Chief Artillery Department placed under the immediate direction of the Feldzeugmeister provided with an Assistant.

The Chief Artillery Department consists of a Committee, the Michael Artillery Academy and the Michael Artillery School.

The following technical establishments are directed by the above Department:

- 1) Fire-arms, gun-powder, and cartridge Works.
- 2) Arsenal, constructing the material parts for the artillery with the exception of guns; one of the arsenals is at St. Petersburg.
- 3) Gun Works and Artillery work-shops; the former are intended for the finishing of guns whereas the latter are occupied in repairs of the material parts of artillery.
- 4) Rocket factory.
- 5) Fuse-Instrumental Works.

The following establishments of the above Department are going to participate in the Exposition:

I. The Michael Artillery Academy and School (at St. Petersburg).

They were both simultaneously established at St. Petersburg on the 25-th of November 1820. The Academy, being formerly called „Officers' classes of the Artillery school,“ received its present denomination in 1855. Both of these Institutions are confided to one Director.

The Michael Artillery school, educating officers for service in artillery, and being at the same time a preparatory school for the Michael Military Academy, accepts scholars from the age of 16 years; they are called „*junkers*“ and are considered in active service. The course of studies is of 3 years, one year in each class: junior, middle, and senior.

The program consists of: Religion, mathematics, (additional objects to the course of mathematics of Corps of Cadets, analytic geometry, differential and the beginning of integral calculus), mechanics, physics (heat and electricity); chemistry (organic and inorganic), artillery, fortification, tactics and military history, topography, artillery, administration, jurisprudence (general and military), drawing, and the Russian, French and German languages.

The graduates are liable to serve $1\frac{1}{2}$ yrs. for every one year passed in the school.

The Michael Artillery Academy is established for the purpose of giving the highest artillery education to officers. It accepts officers, successfully passing a competitive examination, of all the branches and who have been in active service at least 3 years as officer. The entire course of studies is also of three years or one year for each class.

The objects of the program are divided into the chief and subsidiary studies. The former consist of:

- 1) All the sections of Artillery: a) interior and exterior ballistics, b) explosives, c) guns and projectiles, d) resistance of guns to explosion, e) theory and description of the construction of gun-carriages and wagons, f) organization

and tactics of artillery, g) gun-firing, h) Side-arms (*armes blanches*), and i) history of artillery.

2) All the sections of technology: a) metallurgy, b) cast-iron work, c) steel foundry work, d) gun-carriage construction, e) mechanical technology, f) gun-powder manufacture, and g) rifle and cartridge manufacture.

3) All respecting mechanics: a) resistance of materials, b) details of machines, c) hoisting apparatus, d) steam-engines, e) hydraulics and f) the theory of elasticity.

To subsidiary objects appertain: a) fortification, b) strategy, c) the highest mathematics, d) thermodynamics, e) electrotechnics, f) analytic chemistry, g) descriptive geometry and h) the foreign languages.

The graduates of the Academy are obliged to serve one year and a half for every year passed in this institution.

The Michael Artillery Academy together with the school are exhibiting the following:

1) Text-books, published:

N. Maievsky (Artillery-General and Professor of the Academy and the School † 1892): a) Principle of least squares, b) of the solution of problems referring to target and slant firing, c) of ballistic tables for slant firing, modified by Major Siacchi, d) Description of integration, e) of probable deviations from the center of grouping of molecules.

N. Zabdoudsky (Captain of the Guard Artillery and Professor at the Academy): a) Of the solution of problems in slant firing, b) Supplement to the solution of problems in slant firing.

V. Pashkevitch (Major-General, ex-Professor of the Academy): Collection of formulas for the calculation of the elastic resistance of guns to longitudinal explosion.

N. Pototsky (Major-General and Professor at the Academy): a) Artillery projectiles and guns, b) Gun-powder.

L. Kirpitchen (Major-General and Professor at the Academy † 1890): a) Principles of ballistics, b) Principles of mechanics.

N. Gontchar (Captain of Artillery, teacher at the Academy and the school): Magazine and small calibre guns.

A. Brix (2-nd Captain of the Guard Artillery, teacher at the Academy and School): A theoretical course of hydraulics and hydraulic motors.

P. Rostchin (Actual Councilor of State, teacher at the Academy and School): a) Notes on differential calculus, b) Notes on integral calculus.

G. Zabdoudsky (Captain of Guard Artillery and Professor at the Academy): a) Gun-powder manufacture in foreign countries, b) Preparation of large-grained powder in the Russian powder factories.

S. Panpushko (2-nd Captain of Guard Artillery, teacher at the Academy and School † 1891): a) Preparation of pyroxiline and nitroglycerine, b) Hand-book of problems in chemistry.

2) Lithographed Text-books of the Academy and the School:

N. Budaef (Actual Councilor of State, teacher at the Academy): Theoretical mechanics.

N. Zaboudsky (Captain of Guard Artillery and Professor at the Academy): Exterior ballistics. Parts I and II.

D. Chernoi (Councilor of State, Professor at the Academy): Steel foundry work.

G. Zaboudsky (Captain of Guard Artillery and Professor at the Academy): Gun-powder manufacture.

N. Gonchar (Captain of Artillery, teacher at the Academy and School): Gun-carriages and wagons of the Russian artillery, with drawings.

V. Pashkevitch (Major-General, ex-Professor at the Academy): Interior ballistics; parts I and II.

P. Shiff (Captain of Guard Artillery, Professor at the Academy): a) Gun-carriages and wagons, p. I and II, b) Mechanics, c) Solution of problems in mechanics, d) Theory of elasticity.

M. Baranovsky (Colonel of Artillery, Professor at the Academy): Practical or mixed mechanics, details of machines; p. I and II.

N. Pototsky (Major-General, Professor at the Academy): Elements of the construction of fire-arms and projectiles.

F. Vvedensky (Captain of Artillery, teacher at the Academy and School † 1892): Thermodynamics.

3) Practical occupations of officers and junkers studying in the Academy and the School:

a) *Practical occupations of officers in ballistics* — 2 works.

b) *Practical occupations of officers in the theory of gun-carriages*—3 works.

c) *Practical occupations of officers in descriptive geometry* (7 drawings).

d) *Practical occupations of junkers of the senior class in artillery drawing* — 20 exercises.

e) *Practical occupations of junkers of the junior class in artillery drawing* — 1 exercise.

II. Fuse-Instrumental Works (at St. Petersburg).

These Works represent a technical establishment of the Artillery Department and serve for the manufacture of accurate instruments and implements, adopted by the artillery. The Works exhibit the following:

4) An assortment of instruments for verifying the dimensions of field-gun shells.

5) An assortment of instruments for verifying the dimensions of field-gun shrapnels.

6) **Spherometer**—is an instrument for finding and measuring unevennesses on plane surfaces, the curvature of surfaces, and for measuring the thickness of the layers of earth.

The necessary appurtenance of the spherometer is a small steel plate, of a strictly defined thickness, which is laid upon the surface of the measured body. For measuring the thickness of the latter a micrometrical screw is lowered on the plate, the contact with which will be defined by the condition, that, at the further rotation of the head of the screw, the tripod begins to slide on the supporting surface. The number of turns of the screw and the divisions on its top will define the thickness of the object with the plate; in knowing the dimension of this latter, one finds the thickness of the measured body.

7) Universal instrument for the measure of bores and chambers of guns 35 calibers long, from 6 to 12 inches caliber, inclusively. It consists of an exterior tube and of an interior tubular rod moving the interior wedge, which unfolds the measuring parts or spires; the tube and the rod are composed of 6 parts and every part can be separately fastened with the head and handle of the apparatus. The parts are fastened by screws, entering a joining conic muff. The head of the instrument has an ordinary construction and the uniform pressure of the spires or measuring parts is attained by a spring, drawing along the rod of the head part. For the counting off of the divisions the handle is supplied with a small scale fixed to its place by a screw; the vernier of the scale gives a $\frac{1}{625}$ part of an inch and at the falling of the rod, which is 0,05 inch by 1 inch long, the degree of the exact measure will be expressed by the figure $\frac{1}{6250}$ inch. The length of the assembled instrument is of about $5\frac{1}{2}$ sajenes (38,5 feet); on the exterior tube there are divisions up to 360 inches.

The apparatus is drawn out of the bore of guns (generally for small displacements to one side or another) by a cogged rod fastened to the apparatus by little hoops; it is joined with the pinion, the axle of which lies in the sockets, screwed to the nut, placed in the mouth of the gun. The cogged rod can be fastened on any part of the instrument; for each calibre a separate nut is required.

For the measure of guns having a reverse cone, there are 2 folding measuring spires, which are unfolded with the hands when the apparatus is placed in the chamber.

8) Mechanic Brauer's optic instrument († 1892) for the measure of chambers of 9 and 11 inch guns. Its top is supplied with 3 spires; 2 horizontal—measuring; and a vertical, representing the point of the head,—centralizing.

From the interior side of the head, facing the observer, there are the scale and the vernier, lighted by an electric lamp with a reflector.

On the opposite end of the instrument, for the counting off of divisions, a telescope is placed; the minuteness of the counting is to 0,0001 inch.

The centralizing spire is made movable, for which purpose its end is supplied with a pinion, joined with the cogged rod of the steel gear passing along the instrument to its opposite end.

Such a construction enables one to find, in every vertical section of the gun, in lifting or lowering the head of the instrument, the largest dimension

or diameter. The removal of the measuring spires is regulated by a spring, whilst the pressure of the centralizing spire is guaranteed by a counter-weight, attached to the head of the apparatus.

III. St.-Petersburg local artillery Arsenal.

For mechanical tests at the Arsenal, there is a lever press of Mohr and Federhaf's firm in Manheim, Germany. The Director of this Arsenal's workshop, Prince Gagarin, 2-nd Captain of Guard Artillery, has worked out an electric adjustment for an automatic transmoval of the weight along the lever of the press.

9) **Model of the press with Prince Gagarin's implement.** In this model the infraction of the equilibrium of the lever is attained by a cylinder which is fixed to its end filled with water. Depending upon the quantity of liquid in the cylinder, the opposite end of the lever goes up or down, touching the upper or lower contact. The transmission of motion to the weight is made by means of electromagnets and cogged wheels, the direction of the transmovement of the weight depending upon the contact.

B) Engineering.

The inspecting, technical, scientific, educational and economical sections of the Engineer Corps are concentrated in the Chief Engineer Department to which belong: the Engineer Committee and the Nicolas Engineer Academy with the Nicolas Engineer School, providing Engineer officers with an education conformable to the special requirements of that branch of the military service.

Among the duties of the Engineer Committee there are also: a) discussions of questions and suppositions respecting the development of the art of fortification and the examination of projects regarding the construction of fortresses and fortifications; b) examination of regulations, programs and manuals for technical education and training of all the sections of Engineer troops and also suppositions and accounts of their yearly occupations; c) the examination of inventions and of various proposals for the development of the military-engineer technics and of the material parts of the troops; d) examination of annual hypothesis of constructions of the Engineer Department, of projects and estimates for all constructions undertaken by the War Department; e) examination of technical works and reports of the works executed; f) selection of books for engineer and sapper libraries; g) composition of competitive papers and their examination as well as the examination of prize-essays in the „Engineer Journal“.

In the jurisdiction of the Chief Engineer Department there are also district-engineer administrations, fortress administrations, an engineer distance, and separate superintendents of works.

IV. The Chief Engineer Department (at St.-Petersburg).

10) Drawing of the clinic for mental diseases. The new building of the clinic for the insane is constructed for 100 patients: for 70 men and 30 women. This building also contains the dwellings of the employes. The clinic is situated in the Wiborg district of this city near the building of the Military-Medical Academy, in a quiet place distant from the city. It consists of the main building, of 8 pavilions and of a separate kitchen with houses, connected with each other and with the main building by light, warm galleries. The pavilions are arranged at the exterior side of the galleries. All the wards are faced to the southwest and are, therefore, provided with much light.

. In the center of the main building there are: a large vestibule, chancellery of the clinic, a hall for out-patients, hydrotherapeutic section with all the appurtenances, with a water pressure of 2 atmos. and a special room for treating by electricity with an electric bath. There also, at the entry, are 2 reception-rooms for relatives visiting the insane. The rest of the lower part of the middle of the main building is occupied by persons undergoing an examination, and is isolated from the wards of the insane. In the second floor of the middle part of the main building there are a large auditory and the lodging of the director of the clinic, and above it, in the third floor, is the chapel, on one side of which is a cabinet for the studies of doctors and on the other—a library and the archives of the clinic.

The wards are laid out symmetrically on both sides of the chief entry: on the left (west) side—for men and on the right (east)—for women. Between these wards, to the right of the chief entry, there is a large gymnastic-hall and a winter-garden, intended for promenades of the patients during bad weather or strong colds, and also for the assembly of patients for amusements: concerts, dancing, christmas-tree, etc.

The wings of the main building are occupied by the lodgings of doctors and persons belonging to the administration, and also by those for servants and sick-nurses. There are separate wards for every disease; those for quiet and noisy patients are subdivided into rooms for officers and persons belonging to the privileged class, and into dwellings for soldiers and for those of the simple class. The patients of the first category are provided with dwellings consisting of two sections: in one (in the lower story) the day is passed, and the other (on the second floor) serves as a dormitory. The noisy patients and those seriously ill are lodged in separate pavilions. The sections for the seriously ill are supplied with small isolated dwellings, with separate entries from the yard, for infectious insane suffering from small-pox, diphteria, syphilis, etc.

The dwellings are amply spacious, the capacity of air for each man is from 6 to 9 cubic sajenes (2,058—3,087 cubic feet). All the wards are provided with a ventilation supplying a regular and continual change of air from 3 to 5 cubic

sajenes (1,029—1,715 cubic feet), and in the infirmaries up to 9 cubic sajenes (3,087 cubic feet) an hour.

The vault of the main building contains laboratories for researches and work-shops for the occupation of patients.

Behind the building of the clinic there is a wooden, heated, pavilion, adapted for lodging patients when repairs are being made in the chief stone buildings; near to this pavilion is a room for playing at nine-pins, arranged for quiet patients; on the east side of the building there is a fence and an orangery for the winter-garden.

The clinic buildings are surrounded by squares (gardens) the dwellings being, therefore, amply provided with air. There are also separate gardens for every kind of patient. The ground, on which the clinic is situated, is drained, the horizon of the ground water being lowered about 2 feet. All the buildings are raised on arched vaults, elevated at a sajéne above the local horizon; the vaults contain no lodgings and can be, therefore, largely aired or ventilated at any time.

The last three conditions, i. e. many gardens, the lowering of the horizon of ground water, and the arched vaults under all the buildings, considerably ameliorate the hygienic value of the buildings of the clinic.

The rooms of the disquiet and turbulent patients are heated by air, by means of water heat-generators. In all the other dwellings the best heating by water system is adapted, with heating apparatuses placed under the windows, and controllable for management conformably to changes of temperature. The heating of fresh air for ventilation is made by water heat-generators supplied with an artificial air damper. The air heating in the pipes is done by steam.

For cooking purposes the kitchen is supplied with a steam apparatus. The water for the baths and for hydrotherapeutics is also heated by steam.

In each of the hospital sections there is a room containing a kettle with water heated by steam, a steam apparatus for warming food and a tub with a faucet for washing plates, dishes, etc.

The water for such purposes is heated by steam developed in a special building, in the back-yard, in three large steam boilers.

Such adaptations secure the buildings against fire and this has a special importance in establishments for the insane.

A special care has been given by the builder to the finishing of the rooms for turbulent insane: the floors of these rooms are made of thick oak veneers, pressed into hot asphalt. The windows are with iron window-bars and thick plate ship-panes, and shutters; the walls are covered with thin oak planks, representing an elastic surface; the interior surface of the doors is also elastic. Besides that, several other means are tested for the finishing of the walls of these rooms by the adaptation of rubber, saw-dust and of a special sort of solid canvass.

In the new building of the clinic for the insane nothing is forgotten that might be useful to such patients and to their distraction; besides that, here every improvement is adapted which must contribute to the success of clinical observations of the insane and to scientific researches in the region of mental and nervous diseases.

The construction of the above clinic costed 900,000 rbs.

The buildings of the clinic are projected and built by the Engineer-Lieutenant-General Voynitsky assisted by the well known psychologists: Professors: Balinsky, Merjeevsky and Dr. Erlitsky.

Contributor: Builder of the clinic, Engineer-Lieutenant-General *Voynitsky*.

11) Drawings and photographs of the electro-lighting station of the buildings of the Military-Medical Academy and of the Clinical military hospital. This station is established at St.-Petersburg for the lighting of buildings of the Imperial Military-Medical Academy and the St.-Petersburg Clinical military hospital. Besides that, it also serves for the lighting of the buildings of the Clinic Willjé, Michael Artillery Academy and School, St. Petersburg school for assistant-surgeons, Pyrotechnic artillery school, and of the St. Petersburg military prison. These buildings are adjacent to each other. The Electro-lighting station lights all these buildings with 3,200 lamps, of a candle power of 25, 16, 10 and 8 respectively, with the condition of a possible expansion up to 7,000 lamps.

The station is constructed after the plans of the Engineer-Mechanic and Electrotechnic A. A. Lookin, by a special Committee presided over by the Professor of Physics at the Military-Medical Academy Jegorof and under the supervision of the Acting-Chief Commander of Engineers.

The building, being constructed on a concrete foundation of 181 square sajenes, occupies a circuit of 750 cubic sajenes. Its chimney, being 18 sajenes high, has a section of 5,25 square archines.

It consists of a boiler and a machine section, of vaults and of two additional buildings occupied by the lodging of the chief machinist, the surveying laboratory, the Engineer's room and the work-shop for repairs.

In the boiler section there are 3 steam tubular boilers, of Fitzner and Hamper's system, with a heating surface of 160 square metres each, and with a working pressure of 12—13 atmospheres. It contains also one more foundation for the fourth boiler. The boilers are fed as well by the water from the condensers of the steam-engines as by that from the Town water-works.

2 Schihau triple expansion steam-engines of a vertical type. At an initial steam pressure of 12—13 atmospheres and at 170—180 rotations per minute, each machine develops up to 350 horse-powers; every cylinder of the engine has an independent connecting-rod. 2 electric machines of an alternating current, of Pipernovsky's system, form A_7 , made by Hans & C^o at Budapest, of 180,000 watts each, at 2,000 volts and 170—180 rotations per minute. 2 generator-dynamo-machines of a constant current, constructed by Hans & C^o

at Budapest, for 8.000 watts each, form C₈ at 180 volts and 170—180 rotations a minute. The shafts of the steam-engine, the electric machine, of an alternating current, and of the provocator, are successively joined by motionless muffs.

The electric regulation is made by the system of Hans. & C^o with the adaptation of Blati's automatic rheostat.

The current of the dynamo-machines goes from the station by three separate chains of pneumatic silicious bronze mains. The first mains are hung across the streets on ropes; isolators—oiled, are of Johnson & Fellix's system; the total length of all the primitive mains is of 6.000 metres; the next point is situated at about 1.400 metres from the central station.

The chief buildings will be joined with the central station by telephones with a double conduit. In the buildings, the primitive current of 2.000 volts is transformed into a current of 100 volts by means of transformers of the system of Pipernovsky-Dery-Blati of the newest form. The measure of the volts is made by ammeters of Blati's system.

The building with the machine and boiler foundations and with all the interior finishing cost about 60.000 rbs.; the Works' chimney, 18 sajenes high, 8.000 rbs.; the bridge crane for 500 poods, 3.800 rbs.; sewer pipes (cast-iron tube of 12") and drainage cost 6.000 roubles.

All the boilers and mechanisms together with the conduit and all the electro-technical work are made by the firm Podobedof at St. Petersburg for 168.000 rbs.

Drawings: General plan of the locality, front and section of the building of the electro-lighting section.

Photographs: Front, boiler and machine section, the connection board, room for measurement.

Contributor: Builder of the station, Professor of physics at the Military Medical Academy, *Jegorof*.

12) Drawings of the St.-Petersburg military prison. It is constructed for 200 solitary confined persons. The building is heated by water at a low pressure, and is permanently ventilated, giving 3 cubic sajenes of air per man an hour. The heated pure air comes from chambers with water heat-generators and the bad air goes out through draught chimneys, heated by gas. For the extinguishing of fire, should such occur, there are fire-cocks and fire extinguishers of Dic-Lipman's system. It is lighted by electricity. The cost of construction is 600.000 rbs.

Contributor: Builder of the prison, Engineer-Lieutenant-General *Voynitsky*.

13) Drawings of the Cupolaed metallic elevator at Warsaw. The elevator is constructed on a stone foundation with vaults. The upper surface of the foundation represents an inverted cone. On the stone foundation there is an iron cylinder covered from above with a cupola. Under the cone is a chamber which is filled with grain, by means of a special communicator, from the exterior recipient. Along the vertical axis of all the building runs a tube in

which there is a grain-lifter conveying the grain under the cupola and from there to the granary, then by an iron pipe into the grain-store or for the loading of cars. For a better airing of the grain, the elevator is divided in the direction of the radius, by wooden compartments into 12 sections each section being filled with grain and entirely emptied afterwards. The distributing-pipe, placed in the upper part of the elevator, can, by means of a distributing mechanism, direct the grain into any of these sections. Under the bottom of this cone there are cast-iron tubes by which the grain is cleared out of the elevator sections when these latter are to be emptied. The arched lower part of the elevator consists also of 12 sections. One of the sections is supplied with a gas motor, working: 1) the communicator or transporter; 2) grain-lifter; 3) and the ventilator, in the small turret above the cupola; 4) sieves for grain sifting, near the place of inlet and outlet of the grain, and 5) dynamos for lighting the interior of the elevator by electricity. In entering and leaving the elevator, the grain is weighed on automatic scales.

In Warsaw there are four such elevators with store-houses of 3 stories between each of them, for the keeping of small quantities of different grains.

The holes and iron pipes in the floors of the granaries and the endless canvasses along the walls are applied for the airing of the grain, for distributing it evenly on the floors and for loading and discharging it.

At the end of the building there is an elevator receiving the grain from below and conveying it to the sheet.

For throwing the grain from the canvasses, successively, on all the length of the building, a special mobile mechanism is arranged.

All the three story store-houses are joined with the central pipe of the elevator so that the grain may be conveyed from the elevator into the granary and back by a descending pipe.

From the cars the grain enters the recipient and after being cleaned and weighed is conveyed either to the elevator or to any place in the neighboring store-houses of three stories. The loading of cars and wagons is conducted in the same way but only in a reverse order.

All the mechanisms of the elevators and granaries are worked out and constructed by the St. Petersburg Metallic Works.

Contributor: Engineer, Major-General *Starinkevitch*.

14) Model of Lieutenant-General Pauker's gun-lift. The gun-lift of Lieutenant-General Pauker was adapted for the first time about 1860 for the placing of 11" guns in the Cronstadt naval batteries; its idea lies in the utilization of counter-weights for maintaining a concealed mounting. Such a mounting vertically displaces not only the gun but also the gun-carriage with the frame and the platform with its iron foundation. The total weight is of 5000 poods. All this system is balanced on a central screw, threaded in opposite directions; the raising of the screw by one turn lifts the gun in a double ratio. The turning of the screw is made by men or by a steam-motor. The

system, when tested by practical firing, was found to fully answer the conditions of engagement of batteries with the artillery of the fleet.

V. Aerostatic instruction-park (at St. Petersburg).

The aerostatic section is intended for the study and adaptation to military purposes of discoveries and inventions pertaining to aerial navigation. All the administrations of the aerostatic section belong to the Engineer Corps. The aerostatic section consists of: a) an aerostatic park, b) fortress aerostatic sections, formed in time of peace, and c) field aerostatic sections, formed in time of war. The aerostatic park is established for: a) a theoretical and practical training of officers and privates for aerostatic service, b) tests and practical verifications of discoveries and inventions in aerial navigation, c) preparation and care of the material property of the aerostatic sections and d) for the formation of field aerostatic sections in time of war and the completion of the effective force and of the material property of all the aerostatic sections in general.

The aerostatic instruction-park is under the direction of the superintendent of the electrical section of the Engineer Corps. To the park are attached: work-shops for the preparation of the material aerostatic property, an officers' class, a museum of models and a physical cabinet.

The park has two sections: one—permanent and the other—alternate, of officers detached for the study of the theoretical and practical course of aerial navigation and appointed for the completion, in time of war, of vacancies of officers in the aerostatic sections.

15) Map of aerial journeys. Results of observations from balloons made by officers of the aerostatic instruction-park. Experimental investigations of the balance and movements of a non-captive balloon.

The map consists of: 1) a plan of a part of the Russian Empire with numbered lines representing the projections of the routes passed by the balloon during the journeys from the place of ascent to the place of descent; 2) around it, on the sides, are numbered synoptic maps with isobars. Such a map is prepared at the moment when the journey is to take place; 3) above and under, on red lined stripes, are the diagrams of the heights of each flight, noted by the barograph. These curves give a clear understanding of the height attained by the balloon, and of the time that it remained in the air.

All these drawings are found in the work of M. Pomortzef and are so represented on the map as to give a ready understanding.

16) M. Pomortzef's work „Scientific results of 40 aerial journeys“. This book works out 40 aerial flights, made in Russia by the detachment of Military air-navigators (at present the aerostatic instruction-park) and partly by the VII Section of the Imperial Russian Technical Society during the period of 1885—1890.

17) Instrument measuring the azimuth of directions of the movement of clouds. This instrument, proposed by colonel Pomortzef, teacher of meteorology in the aerostatic class of the park, consists of a small theodolite with an adjustment for measuring position angles. It enables one to receive in a few minutes the direction of clouds of all forms, from the highest *Cirrus* to the lowest *Cumulus*, even to 1° — 2° , and besides that, to measure the angle velocity of the transposition of clouds of all forms. This instrument is of great importance in aerial navigation as it enables one, prior to every flight, to lay on the map the route of different atmospheric currents at different heights and to exactly define the route of movement of the balloon, provided clouds be observed somewhere in the sky. It is also of considerable importance for meteorology and for the prediction of weather. The instrument costs 300 rbs.

VI. Nicolas Engineer Academy with School (at St. Petersburg).

The Nicolas Engineer Academy provides officers with the highest education relating to the special requirements of the engineer branch. The Academy is the highest military-educational institution and is attached to the Chief Engineer Department. It receives yearly not more than 35 officers. The full course of studies is of 2 years, and besides that, there is an additional section with a practical course, the studies therein ending on the 1-st of May of the third academic year; the summer months are devoted to surveying and inspection of works.

The program of studies in the Academy consists of: a) fortification, architecture, structural and practical mechanics as chief objects, and b) highest mathematics, descriptive geometry, geodesy, chemistry, mineralogy and geognosy, military history, military administration and the contemporary state of artillery.

The graduates of the Academy of the first section if they had also finished the additional section, are promoted engineers.

The Nicolas Engineer School is at the Chief Engineer Dept. The immediate superintendence of the institution is confided to the Director of the Nicolas Engineer Academy.

The junior class of this school is opened for young men, from the age of 16, who have successfully graduated from the secondary educational establishments. In the senior class are accepted: a) junkers, successfully graduating from the Military colleges, and b) young men of all classes, who have finished their studies in Universities, in the physico-mathematical course, or in other high-schools, in which the foundation of a special education are mathematics and natural sciences, and who have successfully passed an examination in military sciences.

The program of the Engineer School consists of: 1) Religion, 2) universal history and the history of Russia, 3) mathematics, 4) physics, 5) elemen-

tary course of chemistry, 6) tactics, 7) artillery, 8) fortification (field and permanent, mining, attack and defense of fortresses and construction of military communications), 9) elements of architecture, 10) topography, 11) military administration, 12) jurisprudence, 13) practical exercises in the Russian language and in translations from foreign languages into Russian, and in other objects of the theoretical course, and 14) of fortification, topographic, architectural and artillery drawings.

The full course of studies is of three years.

18) Works of Professors and teachers of the Nicolas Engineer Academy and School:

- 1) *Plützensky*: „Field military engineering.“
 - 2) *Kirpichef*: a) „Railways“; b) „Instructions for sapper battalions“.
- Section III. „Military communications“. Parts 1-st and 2-nd. „Military bridges“; books 1-st and 2-nd.
- 3) *Cüi*: „A brief historical sketch of permanent fortification, with drawings,“ and „Field fortification“.
 - 4) *Vedeniapin*: „Course of heating and ventilation“. Parts 1-st and 2-nd, with drawings.
 - 5) *Miller & Modrach*: „German-Russian military-technical dictionary.“
 - 6) *Jocher*: „Permanent fortification.“ „Siege war“.
 - 7) *Pauker*: „Structural mechanics“.
 - 8) *Ivanof*: „Military buildings“. 2-nd edition.
 - 9) *Velitchko*: „Investigation of the newest means of siege and defense of land fortresses, with an atlas of drawings.“
 - 10) *The same*: „Defensive means of fortresses against sudden attacks“.
 - 11) *Saveljef*: a) „Materials for the history of engineering in Russia“; b) „Historical sketch of the engineer administration in Russia“; c) Alphabetic hand-book of new and old technical words relating to architecture, engineering and chemistry“. 1-st and 2-nd parts.
 - 12) *Karlovitsh*: a) „Basements and foundations“; b) „Construction of the Admiralty embankment at St. Petersburg“; c) Sanitary-engineer sketches“; d) Structural mechanics“; e) Construction of the Moorhab estate of the Emperor“; f) Architectural-memorandum-book for 1879“.
 - 13) „Journal of Military Engineering“ for 1890, 1891 and 1892.
- Contributors*: The authors.

19) Models of exercises of officers studying at the Nicolas Engineer Academy. Album of their graphical works:

A) Graphic works of officers of the junior class of the Academy. Every officer is obliged to present: 1) in fortification: a) during the first half year—drawing of a permanent front or separate fortification, b) during the second half year—a project of an attack of forts or part of the chief rampart on a given place; 2) in architecture and drawing— not less than two drawings of ornaments and orders from originals or plasters; 3) in trigonometric drawing—plane-table, plotted in conditional marks, and a drawing of a situation by Leman's method, made in India-ink; 4) in

practical survey—a surface of 2 square versts, instrumentally taken, scale 100 sajenes; a surface of 12 square versts, by eye-sight, scale 200 sajenes, and a surface of $\frac{1}{2}$ verst of a minute levelling showing the contours, scale 50 sajenes to an inch; besides that, every officer participates in the composition of calculations and bring in the trigonometric work on the paper.

B) *Graphic works of officers of the senior class of the Academy.* Every officer is bound to work out: a) in fortification—a minute project of a permanent or temporary fort on a plane surface; b) in building—detailed projects of structures in stone and that in carpentry separately, and also in earth and other works; c) in architecture—details of two small structures, one of stone and the other of wood, and d) in fortification tactical works in the field—every officer must partake in the solution of 2 large problems referring to the fortification of positions and in two small ones given by the professor.

C) *Graphic works of officers of the additional section of the senior class* Every officer is obliged to work out: a) in fortification—a project of a temporary or permanent fortified point, on a given place, with a given strategic signification, with a detailed finishing of one of the forts or of a part of the chief rampart, with an explanatory note and calculation: of the garrison, armament and cost; b) in architecture—project of a barrack, hospital or some other military building, on a given place, with explanatory notes and 2 estimates: detailed—for one of the structures of the project and the other, approximate—for all the structures of the project, together with a calculation for the heating and ventilation; c) in structural mechanics—calculations: of the stability and solidity of the arch, of an iron and wooden pavement girder or of an iron rafter of a given span, and 6 etudes in the mechanics of machines: a problem on steam expansion, project of a trunnion of a given weight, project of a car axle, of a water-wheel or working beam, project of a factory shaft for a given work, project of a muff for the factory shaft and project of a hoisting machine for structural works.

20) Models of exercises of junkers of the Nicolas Engineer School. Album of their graphic works.

Every junker has to execute: a) in fortification drawing—with India-ink, all the types of expeditions and field fortifications generally used, with the drawing and painting of the last sketch given in the year; b) in architectural drawing and tracing—2 drawings of ornaments made with the lead-pencil and India-ink; c) in topographic tracing—drawings of a situation scale by Leman's system and of a small hill, and the representation by situation of a part of a mountain, and d) in practical surveying—to survey with 2—3 men, a plane-table and a compass, a surface of $\frac{1}{2}$ square verst, scale 25 sajenes to the inch.

C) Intendancy.

The Chief Intendancy being under the direction of the Chief Intendant, represents a central organ of the War Department in which are concentrated: orders and care for the accurate and timely supply of troops and military institutions with: monies, clothing, provisions, and also with everything required by hospitals and infirmaries.

The Chief Intendancy is provided with a Technical Committee which is occupied also in the: a) examination of questions relating to the composition and development of rules for the preparation, acceptance, and conservation of

articles and subsistence supplies; b) completion of descriptions for the technical estimation of all articles, aliments, etc. supplied by the Intendancy, and c) execution of different tests and investigations relating to intendancy technics.

Under the superintendence of the Chief Intendancy there are:

a) *district Intendancy Departments*; their duties consist in the supply of money, clothing, provisions, etc. to the troops and military institutions located in the districts.

b) *Store-houses*; established for the preservation of things and articles required for the present supply of troops and hospitals, and of those which are kept in stock for different destinations.

c) *Equipment work-shops*; for the equipment and outfit of recruits and also of soldiers from the reserve, in case of increase of troops.

d) *Wagon work-shops*, for the construction of wagons for troops and military-medical institutions.

e) *Military biscuit bakery*, for preparing hard-bread,

f) *Military-steam bakeries*, for the preparation and distribution of bread to the troops.

g) *Military-steam flour-mills*, for grinding rye and wheat into flour.

h) *Hay-press house*, for hay-pressing by mechanical means.

i) *Commissary-stores* for the preservation of aliments for the current supply of troops and hospitals, and of those stored as reserves for different destinations.

The Intendancy section will be represented at the World's Columbian Exposition by the Chief Intendancy Department and by its Technical Committee.

VII. Chief Intendancy Department (at St.-Petersburg).

The equipment of the troops is prepared by the intendancy work-shops at Dvinsk, Kiev, Moscow and Tiflis. The boots, slippers, etc. are made by machines, the successive operations being shown in the exposed models. The samples of sewn equipment and boots are made at the Dvinsk equipment work-shop.

21) Models of sewn-equipment for privates of the:

a) Life-Guard Preobrajensky Regiment.

b) Life-Guard Dragoon

c) 2-nd Sophie Infantry Regiment of His Majesty.

d) 6-th Life-Dragoon Pavlograd Reg-t of His Majesty.

e) 1-st line Turkestan battalion.

f) 1-st Caucasian (native) rifle drujina.

The articles of sewn-equipment: uniforms, trousers, overcoats, stocks, hats, caps and linen shirts, are made by different measures established on the basis of data of the $\frac{0}{10}$ number of soldiers of different sizes in the troops. The chief articles of equipment, as the uniforms, trousers and coats are cut for four measures, this being possible when the buttoning of uniforms and coats is replaced by hooks and eyes (without button holes) which permits convenient fitting on the soldiers.

22) Samples of the machine-made boots for soldiers, at different stages of the making:

1. a) The cutting of soft shoe-leather: of the uppers and of 2 boot-legs (the front and back) with the quarter sewn to it.
- b) The sewing of the front to the front boot-leg. } On an ordinary
- c) " " together of the front and back boot-leg. } sewing-machine.
- d) " " " " " " " of both boot-legs on a tubular sewing-machine.
- e) Insertion of the counter into the back boot-leg.
- f) Stretching of the boot on the last.
- g) The sewing of the stretched boot to the inner sole with the wax-end.
- h) The rubbing of the inner sole with shoe-maker's wax.
- i) Inner sole of leather.
- j) Placing in the sole.
- k) Securing it with pegs.
- l) Preparation of the shank.
- m) The laying of the sole and instep.
- n) } Fitting and nailing on the heel.
- o) }
- p) Finishing of the heel tap and sole.
- q) Final finishing of a pair of boots.
2. a) Cutting of soles, half-soles (new-soles), heel taps, insteps and heels of sole leather.
- b) Cutting of the inner-sole and lining made of thin finished leather.
- c) " " " quarters and boot-straps of Russia leather.
3. Three boxes of wooden pegs and a box of iron ones.
4. Black flax wax-end for sewing the boot-legs.
5. Flax thread for wax-end.
- a) in a raw state,
- b) soaked in shoe-maker's wax.
6. Pair of ready-made boots.

The boots are made for the troops in 8 sizes, for determining which it was necessary to measure the feet of 12.000 privates. The making of boots is carried on in the equipment work-shops by machinery as well as the cutting of the soles, half-soles, sole-linings, backs, heel taps, insteps and heels, in order to conserve the proper form and proportions of these parts.

VIII. Technical Committee of the Chief Intendancy Dep-t (established at St.-Petersburg in 1867).

23) Adaptations for the exterior examination of grain:

- a) model of a probe,
- and b) single microscopes specially adapted.

These adaptations serve to define the quality of grain when receiving it for the supply of troops.

The probe serves to take samples of the grain and the microscopes to examine them.

24) Instrument for determining the nature of the grain:

a) Isaef's implement for all grains, specially adapted for Russian commerce, in russian units of weight and measure (chetverik ¹⁾ and pound ²⁾).

The implement itself represents a $\frac{1}{32}$ part of a russian chetverik; the little balance-weights attached to it form also a $\frac{1}{32}$ of a russian pound, i. e. lot ³⁾.

It is employed in the Intendancy when examining grain furnished in small quantities (about $1\frac{1}{2}$ —2 lbs.).

b) Funnel for determining the size-weight of grain; it consists of an iron funnel with an opening bottom, an iron measure (chetverik), a wooden rake and of a level.

This apparatus is adapted when grain is accepted or delivered. It was planned by the Technical Committee of the Chief Intendancy for the establishment of the same constant conditions of the size-weight of grain in one chetverik ($\frac{1}{8}$ of a chetvert).

The funnel is filled with grain, the chetverik being under it at a defined distance; then the similar conditions of the strewing of grain from the funnel into the chetverik is attained. For the correct horizontal adjustment of the apparatus, it is supplied with a level and with balancing screws.

25) Instruments showing the quantity of impurities in grain: 1) Scales made of horn with balance-weights in grammes; 2) metallic sieve of many rows with round stamped holes for the separation of round impurities (round vegetable grains) and of dust and sand; 3) zinc hand-analysers (trays) with round cavities for the separation of round impurities (as peas, tare, mustard seeds, etc.); 4) zinc analysers with oblong holes for the separation of: husk from rye, barley from oats, large grained oats from the small grained; and 5) a tin plate and hand-shovel for mixing grain samples in order to receive a general mean sample for the analysis.

The analysers pertaining to the instrument represent metallic trays with cavities and holes, of different forms, for detaining or passing, through the holes of different vegetable or mineral impurities found in the grain.

26) Apparatus defining the quantity of water contained in forage: grain, groats, bread, crackers, preserves, etc.

This instrument consists of: 1) Robervall's scales, 2) of a water basin—a drying copper case with a thermometer; 3) exsiccator; 4) two metallic cups; 5) a mortar of porcelain with a pistil; 6) a hand-mill for grain grinding;

¹⁾ 1 chetverik = 5,77 galls.

²⁾ 1 Russian pound = 0,90 lb. avoirdupois weight.

³⁾ 1 lot = 0,45 ounce.

7) iron pincers; 8) benzine lamp and 9) of two flasks with chlorids of potassium. The instrument serves to define the dryness of supplies intended for the Intendancy. The parts of the instrument are used for the grinding, weighing and drying of the supplies.

27) Transportable laboratory for the examination of flour:

1) The adaptations for the exterior examination of the flour, its color, and test of the quality of the grinding, are: a) microscope, b) Pecar's board and a wire sieve of six rows, made of wire under № 12, 15, 20, 25, 30, 35.

These adaptions serve to define the cleanness of the flour, the coarseness of the grinding, etc.

2) Implements for the chloroform test of flour: Instrument of D-r Rakovitch, consisting of: a) three flasks for chloroform, alcohol and diluted sulphuric acid; b) assay-pipes with equal divisions (cubic centimetres); c) pipette for taking alcohol and sulphuric acid; d) copper measure for tested flour; e) spoon for filling the measure with flour; f) thermometer of Celsius and g) a little brush for cleaning the pipes.

Observation. The test of the flour by chloroform enables to define:

a) the quality of the grinding; b) impurity and purity of the flour; c) quantity of moisture in it; d) intentional admixture of mineral substances; e) admixture of spur and of diverse seeds as black peas, tare, etc. and f) mixture of flour with other grains.

3) Implements defining the quantity of spur in the flour by means of carbonate of potassium, consisting of: a) Assay-pipe (with 2 lines) solidly entered into wooden legs; b) pipettes; c) measures; d) spoons; e) brush for cleaning the assay-pipes; f) microscopes, and g) dissolved carbonate of potassium of a specific gravity of 1.32.

4) Implements defining the quality of flour: Assay-pipe, a mortar, solution of Nessler and dissolved natron.

5) Adaptations defining the moisture of flour: technical scales with balance-weights in grammes, desiccating copper box, with a spirit-lamp, exsiccator, etc.

6) Adaptions for microscopical examination of flour: microscope, dissolved natron, tincture of iodine and tables giving a microscopic representation of starch substances of plants, their substitutes and admixtures.

7) Areometers with a cylinder, litmus papers, paper firtres, corks, reserve assay-pipes, pipettes, glass sticks, spoons, etc.

28) Album with samples of cloths manufactured for the troops.

29) Tables showing the change in the color of cloths by different reactions for the determination of the durability of their dyes. The examination of cloths, as to the durability of dyes, shown in the tables, is made when the cloths are received into the store-houses from the fabricants.

Up to 1864 the overcoat, uniform and trimming cloths were manufactured of wool of ordinary sheep. The development of factory industry and sheep-breeding has enabled us to prepare cloth from finer (merino) wool.

The working out in 1864 of new samples of cloth for the troops resulted in the establishment of three categories of cloths: 1) that for overcoats, made of common wool, 2) cloth for uniforms and trimmings, of fine (merino) wool, and 3) cloth of camel hair for cowls (*bashliks*).

With the development of the technics of cloth manufacture and the discoveries in the region of applied chemistry, relating to dyeing pigments, the War Department had also changed its requirements respecting cloths intended for the troops. The changes in the manufacture of cloth ended in the working out and introduction of: a) new ameliorated sort of gray cloth produced from Russian wool, for overcoats, b) a finer trimming light cloth and c) in the introduction of more durable pigments less changeable in the wear of the cloth.

At present the troops are supplied with the following cloths:

- 1) Cloths of merino wool — for uniforms and trousers.
- 2) Light colored cloths of merino wool — for the uniform trimmings.
- 3) Russian woolen cloth — for overcoats, and
- 4) Cloth of camel hair, for cowls.

All the cloths are napless. Their standard width is 30 vershoks (1 vershok = 1,75 inch), so that 1 arshine of such width equals 480 square vershoks.

Cloths of the 1-st category are for uniforms and must be made out of the best sorts of merino wool.

The wool must be free from shoddy, flocks or other impurities. The weight of an arshine of its standard width (30 vershoks), the number of threads of warp in each square inch, the weft and strain (defined by a dynamometer) sustained by the cloth, are given in the table below.

The cloth must be compact, elastic, not drawn on frames and of a good exterior aspect. The foundation color for uniform cloths is dark green. Some Cavalry and Cossack regts. have white, blue, scarlet, crimson, brown and olive dyed uniforms; wagon-battalions have gray clothing. The gray-blueish cloth is made for trowsers used in the cavalry.

The following are the colors for trimmings: scarlet, crimson, rose, madder, turquoise, light blue (sky-blue), blue, light green, lilac, brown, gray, white, black, yellow and orange.

At the establishment (in 1864) of methods for dyeing uniform and trimming cloths, only those pigments were estimated which were then known to the technics of dyeing as being the most durable. They all belonged to the animal and vegetable kingdoms.

The introduction of pigments received in the working of naphtha was strictly forbidden, as in those times only the aniline pigments were known.

In the working out of new ways of dyeing, the Technical Committee of the Chief Intendancy Department requires the dyeing to change as little as possible from the influence of air and moisture, of sun and light in general,

street dust (lime, alkali), sweating and from gases observed in barracks and stables. Besides that, the dyeing must not be effected by water, spirits, by rubbing, and in general by all that is to be supported by the cloth when worn.

The manufacturers are not restricted as to the choice of pigments provided the durability of the dyeing corresponds to the requirements established.

The dark green color of the uniform cloth is reproduced with sandal on a chromium ground.

When it was introduced, it belonged to one of the cheapest and most durable dyes. At present its inconvenience is very great and it requires to be replaced by some other more durable dye. Cloths of mixed colors — gray and grayish blue; they must absolutely be dyed in the wool with alizarine for the gray stuff and indigo for the grayish blue cloth.

Blue cloths for uniforms and trimmings are covered with blue sandal, with salt of aluminium on a thick indigo ground, reproduced by the indigo dyeing of the wool.

The olive, brown and light-green colors being formerly reproduced by means of tree pigments are now produced with alizarines. The lilac color — by galeine and alizarine. The orange color has up to the present time been produced by flavine and cochineal and the yellow color by flavine; both these colors largely change in the wearing from light, air and moisture. A more durable yellow and orange are being worked out. Up to the present time the scarlet and rose cloths have been dyed with cochineal, in the wear their color changes and receives a crimson shade; a new pigment is being projected for the production of these two colours. The crimson color is reproduced by cochineal with alum and the reddish — by madder.

The black is received by a sandal extract after boiling in a solution of iron salt.

The cloths of the 2-nd category, (trimming), are light and must be made of a selected merino wool, free from impurities, and have to answer the conditions stated in the table below.

The requirements as to the correct manufacture of the cloth and of its exterior aspect are the same as those established for heavy cloths of the 1-st category.

The cloth of the 3-rd category or that for over-coats, is manufactured of definite sorts of Russian wool, of a mixture of white and black wool of a natural color; but as wool of a quite dark color can be comparatively rarely seen on sale, the reddish being more oftenly met, it is permissible to dye it slightly with fully durable pigments, as alizarine and others.

In the preparation of this material there is one condition, that, after removing the dyeing pigments from the cloth, it must change very little, not more than in the existing pattern.

The technical conditions to be answered by the overcoat cloth are given in the same table; as regards the requirements for the correct manufacture

of this cloth, as well as of that made of camels hair and employed for cowls, they are identical to those for uniform cloths.

The cowl cloth or that of the 4-th category is made of undyed camel hair and must answer the following technical conditions:

Technical conditions for the acceptance of cloths for the troops.

Categories.	W E I G H T.					Number of threads in a square inch.			The tearing strength of piece 7" long and 3" wide.		
	Of a standard arshine with list.		Of list for a standard arshine.		Of a standard arshine without the list.	In warp.	In weft.	On an ave- rage.	In warp.	In weft.	On an ave- rage.
	Lbs.	Zol.	Zolotniks.	Lbs.	Zol.						
	P o u n d s.										
	N O T L E S S.										
Uniform and sound colored cloths	1	17	7	1	10	42	44	86	60	60	160
Light trimming cloths . .		90	5		85						
		96	5		91	44	50	94	60	60	160
Over-coat cloth	1	72	7	1	65						
	1	82	7	1	75	32	21	53	130	100	240
Camel hair cloth for cowls (bashliks)	1	40	7	1	33	36	22	58	140	100	250

D) Military-educational Section.

Up to 1831 the Military educational-institutions formed no general regular organized administration. It was only in that year that they were placed under the direction of a special central department annexed to the Ministry of War in 1863 and then called „Chief Administration of military-educational institutions“, which are directed by the Chief Commander of these establishments.

Among the affairs concentrated in the Chief Administration of the military-educational institutions there are: a) the „*personnel*“ and interior management of the establishments and b) the admission, tuition, education, and graduation of scholars. To this Administration are annexed: 1) a Pedagogical Committee, considering questions relating to education and supervision of manuals and text-books newly issued; and 2) a Pedagogic Museum of military educational-institutions established in 1863 for the purpose of serving as a constant exposition of models of military manuals, of supplying them to the military schools and army-sections and of assisting the publishing of reading-books for soldiers. At present the Pedagogic Museum, representing a section of the „St. Petersburg Museum of applied sciences“, is administered by a special Director who presides over the military-educational committee of the Museum and of that for the interior management. The special sections of the military-educational

tional committee, work out questions relating to the amelioration of the educational state of teaching in the classes and discuss measures respecting the bringing up of children in general. The Administration of the museum, in arranging gratuitous readings for soldiers and public lectures in different branches of sciences, has also established musical classes, accessible to every one, classes of gymnastics and singing for children, lessons of fencing and a gratuitous library of religious-moral books; besides that, it has also organized a church choir.

For more ample information concerning the Pedagogical Museum, see brochure „*The Russian Pedagogical Museum of Military School Establishments*“, specially written for the World's Columbian Exposition.

The Russian military-educational institutions (boarding-schools) are subdivided, conformably to their purpose and organization, into three categories:

a) Institutions with a special-military course, for the education of officers, are Military colleges: one cavalry and three infantry, the special classes of the Corps of pages of His Imperial Majesty, and the classes of the Finland Corps of cadets;

b) Institutions with a secondary general-educational course prepare their scholars to enter establishments pertaining to the first category; they are—the Corps of cadets (20), the general classes of the Corps of pages, and those of the Finland Corps of cadets;

c) Institutions with the lowest general-educational course, they are: two military schools established exclusively for the continuation of the education of cadets dismissed either for want of capacity or for moral depravity.

a) Military colleges and special classes of the Corps of Pages.

The junkers of colleges and the pages of the special classes are considered in active service with the rights of volunteers and the corresponding obligation to serve, after graduating, one year and a half for each year passed in the college.

The full course of studies is of two years, the programs consist of: Religion, Russian, French and German languages, mechanics, chemistry, tactics, military history, artillery, fortification, military topography, military administration and law, and besides that, hippology at the cavalry school.

The practical training of junkers consists in the study of Army regulations, gymnastics, fencing, target-practice, mounting and vaulting (in the cavalry school) and also in participating in the company interior economy. In summer the junkers leave for the camp. The graduates are promoted officers.

The total number of junkers of military colleges and of those of the special classes of the above 2 Cadet Corps is 1.500 men.

The average cost of support per annum of a junker is 580 rbs. in the infantry and 1.070 rbs.—in the cavalry school.

b) Corps of Cadets.

These institutions, admitting boys from 10 to 18 years of age, are chiefly established for sons of officers of merit and give a general education within the limits of their object. This education, imbibed with the spirit of Christian religious doctrines and in concord with the Russian governmental organization, is intended to prepare scholars for their future service to the Emperor and the native country.

For this purpose in the scholars are gradually developed those true ideas and tendencies which serve as a solid basis for sincere devotion to the Throne, the sensible obedience to the authorities and the laws, and sentiments of honor, truth and honesty.

The cadets are divided into companies (about 100 boys in a company).

The senior company has a drill organization; the training is carried on with arms, in order to prepare cadets in drilling, to pass into military colleges.

The cadets of the corps follow a general educational course of studies of 7 years, one year in each class.

The program consists of: Religion, Russian, French and German languages, mathematics (arithmetic, algebra, geometry, trigonometry and analitic geometry), elements of natural history, physics, cosmography, geography, universal and Russian history, fundaments of jurisprudence, caligraphy and drawing. Besides that, the scholars are taught: drill, gymnastics, fencing, handicraft, swimming, music, singing and dancing.

In summer, the senior company of the Corps is sent to camp for 5—6 weeks for military-training. The Corps' graduates then enter the military colleges. The total number of scholars educated in the Corps of cadets and in the general classes of the school of pages is about 8.000. The average cost of support per annum of each cadet is 450 rbs.

c) Military schools.

They are established for youths who, through absence of capacities or other educational considerations, cannot remain in the Corps of cadets. There are two such schools in Russia, i. e. at Jaroslavl and Volsk. They have a four year elementary educational course; the program of studies consists of Religion, the Russian language, arithmetic and elements of algebra, geometry and geometrical drawing, history, geography, elements of natural history, caligraphy and drawing.

The graduates of these schools, on reaching the age of 17 yrs., are enrolled into regiments as volunteers of the 2-nd section. They can enter the district junker colleges, the graduates of which receive the right to be promoted to the rank of officer. The cost of support of a scholar at the Jaroslavl school is 250 rbs. and that of a scholar of the Volsk school—500 rbs.

The total yearly expenditure for the maintenance of all the military-educational institutions together with their central administration and with the

constructions or repairs in their buildings, amounts to 5,112,000 rbs. Excepting the incomes derived from payments of paying-inmates of Cadet Corps and of the Cavalry school, the actual government expenditure for the maintenance of the military-educational institutions is—4,100,000 roubles.

The following establishments are participating at the Exposition:

IX. Pedagogic Museum of the Military educational-institutions.

In arranging collections for the Chicago Exposition, the Museum keeps in view the educational course of Cadet Corps as that of general educational-institutions of a real character.

The classification of studies of the educational course of Corps of cadets by classes, is represented in the following table showing the number of lessons a week:

L e s s o n s.	C L A S S E S.							TOTAL.
	I	II	III	IV	V	VI	VII	
I. Religion	2	2	2	2	2	2	2	14
II. Russian language and literature .	5	4	5	4	4	4	4	30
III. French language	6	5	4	4	4	3	2	28
IV. German language	—	5	6	6	4	3	2	26
V. Mathematics	5	4	5	6	7	6	6	39
VI. Elements of natural history . .	—	—	2	2	2	2	—	8
VII. Physics	—	—	—	—	2	4	3	9
VIII. Cosmography	—	—	—	—	—	—	2	2
IX. Geography	2	2	2	2	—	—	2	10
X. History	—	—	2	2	3	4	3	14
XI. Law	—	—	—	—	—	—	2	2
XII. Calligraphy	3	2	—	—	—	—	—	5
XIII. Drawing	3	2	2	2	2	2	—	13
Obligatory additional occupations	—	—	—	—	—	—	2	2
Total	26	26	30	30	30	30	30	202

The following articles are exposed by the Pedagogical Museum:

30) Materials relating to the interior organization of the military-educational institutions:

1) Regulations, instructions and programs for Corps of Cadets: Regulations of Corps of Cadets, instructions and general program for teaching, general program of the regulation of study hours and instructions for conducting out-of-class occupations.

- 2) Instruction to the doctors of these institutions.
- 3) Instruction relating to the educational section and programs for teaching in military colleges.
- 4) *Lalaef*. „Historical sketches of military - educational institutions“: a) 1700—1880 and b) 1881—1891.

31) Text-books, maps, etc. for studying Religion:

In respect to means for a demonstrative study of Religion by pictures and designs, the Russian school was long under western influence; it is only about 20 years ago that it began to free itself from this influence thanks to the development of Russian archeology and to the works of the Academicist Solntsef ¹⁾, the investigator of the byzantine style. It is to his energy, that one must ascribe the apparition in Russia of religious designs and pictures of a byzantine style which preserves the traits of eastern life and gives a comprehension of the religious events conformable to the Orthodox church and to its traditions.

- 5) The teaching of Religion by pictures. Published by Sidorsky. Price 3 rbs.
- 6) The teaching of Religion by pictures. Published by Dumnof. Price 4 rbs.
- 7) Pictures for the elementary course of Religion published by the Map-Establishment of Ilyin and by Fenoult & Co, Booksellers. Price 4 rbs.
- 8) *Krükof*. The teaching of Religion by pictures. Published by Bakochi, Sidorsky & Co. Price 26 rbs.
- 9) *Mihailovsky*. „The principle holidays of the Orthodox church with text and exemplary lessons“. Pr. 1 r. 50 c.
- 10) *Bahmetef*. „12 holidays and the Resurrection of Jesus Christ“. Pictures with an explanatory text. Pr. 4 r.
- 11) *Petrof*. „Biblical Atlas and biblical historico-geographical dictionary“. Pr. 2 rbs.
- 12) „Map for the study of the Old and New Testaments“. Published by Ilyin. Pr. 80 c.
- 13) „Map of the Land of Canaan“. Published by Ilyin. Pr. 50 c.
- 14) „Map of Palestine“. Published by Ilyin. Pr. 50 c.
- 15) *Marenin*. „Map of 4 eastern patriarchies and of the Roman patriarchy“. Published by Ilyin. Pr. 1 r. 50 c.
- 16) *Archpriest A. Rudakof*. „The Old and New Testaments“. Pr. 1 r.
- 17) *Archpriest D. Sokolof*. „The Old and New Testaments“. 2 parts. Pr. 60 c.
- 18) *Archpriest A. Rudakof*. „A brief study of the Divine service of the Orthodox church“. Pr. 50 c.

¹⁾ His book, entitled «Antiquities of the Russian Empire», placed in the collection under № 323, gives an idea of his works.

19) *Archpriest P. Lebedef.* „Manual for understanding the Divine service of the Orthodox church“. Pr. 85 c.

20) *Archpriest D. Sokolof.* „Study of the Divine service of the Orthodox church“. Pr. 40 c.

21) „A detailed Christian catechism of the Orthodox catholical eastern church“. Pr. 15 c.

22) *Archpriest A. Rudakof.* „History of the Christian Orthodox church“. Pr. 1 r.

23) *Archpriest Smirnof.* „History of the Christian Orthodox church“. Pr. 1 r.

32) Mathematics.

The small collection of text-books and instruments are intended for the study of: a) arithmetic, b) geometry and c) algebra.

The implements for the study of arithmetic are: a) the arithmetical box and count-board used for teaching children whole numbers and fractions, and b) models of Russian measures and a map, published in Russia, to familiarize scholars with the metric measures.

Implements for geometry: a) models of geometric bodies used in teaching the elementary and partly the systematic course of geometry, and b) implements for black-board drawing: ruler, triangle, compass, etc.

33) Implements and manuals for the study of arithmetic.

24) Russian commercial count-board. Pr. 1 r. 15 c.

25) Arithmetical box, for studying whole numbers from 1 to a 100. Pr. 2 r.

26) *Kohovsky's* class count-boards, for the study of whole numbers and fractions. Pr. 7 r.

27) Collection of linear measures: a folding sajene (7 feet), three feet, a foot (1 english. foot), an arshine (0,77 yard), and a mètre. Pr. 2 r. 20 c.

28) Collection of capacity measures: a) for dry measures: chetverik (5,77 galls), half chetverik, garnetz (2,88 quarts); b) for liquid measures: vedro (2,70 galls), half a vedro, $\frac{1}{10}$ of a vedro, $\frac{1}{100}$ of a vedro. Manufactured by the St. Petersburg work-shop of educational implements. Pr. 5 r.

29) *Bop.* „Table of metric weights“, with explanatory text. Published by Fenoult & Co. Pr. 1 r. 50 c.

30) *Shohor-Trotsky.* a) „Essay on methods of arithmetic“. Pr. 1 r. and b) „Purpose and means for teaching lowest mathematics“. Pr. 60 c.

31) *Jevtushevsky.* „Book of arithmetical problems for the primary and systematic course“. Pr. 40 c.

32) *Simashko.* „Arithmetic“. Pr. 75 c.

33) *Shohor-Trotsky.* „Text-book of arithmetic for secondary educational institutions“. Pr. 65 c.

34) *Vereschagin.* „Book of arithmetical problems“. Pr. 80 c.

35) *Shohor-Trotsky.* „Method-book of arithmetical problems.“ Pr. 70 c.

36) *Voronof.* „Collection of arithmetical problems“. Pr. 30 c.

34) Geometry and Algebra.

37—41) *Krinitzin*. Collections: a) paste-board models of geometrical bodies. Pr. 6.75; b) polished wooden models of geometric bodies. Pr. 45 r.; c) wooden implement for measuring the height of geometric bodies. Pr. 1.50; d) a folding half chetvert square prism. Pr. 4 r. for the paste-board and 20 r. for the wooden, and e) a folding cubic chetvert according to formula: $(a + b + c)^3$. Pr. 3 r.

42) Implements for geometrical drawing in the class. Pr. 4.50.

43) *Fedorof*. „A graphic representation of the numerical correlation between the elements of an octagon“.

44) *Fedorof*. „Models and drawings of paralleloedres“. Pr. 35 r.

45) *Davidof*. „Elementary algebra.“ Pr. 1.65.

46) *Bitehkov*. „Book of examples and problems to the course of elementary algebra“. Pr. 1.35.

47) *Prjevalsky*. „Collection of algebraic problems. Pr. 1.25“.

48) *Simashko*. „Elementary geometry“. Pr. 2 r.

49) *Prjevalski*. „Collection of geometrical theorems and problems“. Pr. 1.60.

50) *Shohor-Trotsky*. „Text-book of geometry for secondary educational institutions“. Pr. 1.25.

51) *Simashko*. „Trigonometry“. Pr. 1 r.

52) *Prjevalsky*. „Five figure tables of logarithms“. Pr. 75 c.

53) *Erolof*. „Application of algebra to geometry and elements of analytical geometry“. Pr. 1.25.

35) Foreign languages.

Of the French and German text-books existing in Russia only those are exposed which answer more fully the programs of Corps of cadets.

Teaching of foreign languages in Corps of cadets: a) in the four junior classes special attention is given to the practical study of the language and to the most important grammatical forms; b) in the three senior classes, attention is given to the practice of the language and to its systematic grammar. The texts for translations into Russian are selected from chrestomathies; in the last two classes the study of historical works is chiefly followed.

a) French language:

54) *Fenoult*. „Premières leçons de français d'après les tableaux“. Pr. 70 c.

55) *Margot*. „Cours élémentaire et progressif de la langue française, à l'usage des classes inférieures et moyennes des écoles“. Pr. 0.80 c.

56) *Haushild*. „Nouvelles leçons de français“. Pr. 0.80 c.

57) *Ignatovitch*. „Concentric manual of the French language comparatively with Russian and Latin“. 3 vols. Pr. 1.25.

78) *Rancé*. „Manuel élémentaire et pratique de la langue française. Pr. 1.15.

59) *Challandes*. „Cours complet de langue française“. Pr. 1.35.

60) *Varon*. „Cours élémentaire méthodique et pratique de langue française“. 2 p. Pr. 1 r. 65 c.

61) *Moser*. „New elementary manual of the French language“. 3 parts. 1 r. 50 c.

62) *Margot*. a) „Grammaire théorique et pratique de la langue française“. Pr. 1 r. 40 c.; b) „Grammaire française comparée à la grammaire russe“. Pr. 2 r.

63) *Rançy*. „Nouvelle grammaire française à l'usage de la jeunesse russe. Lexicologie et syntaxe“. Pr. 1 r. 15 c.

64) *Hoppé*. „Grammaire concise de la langue française“. Pr. 60 c.

65) *Hoppé* et *Dollos*. „Exercices pratiques de grammaire“. Pr. 90 c.

66) *Challandes*. „Grammaire française élémentaire à l'usage des établissements d'éducation“. Pr. 2 r.

67) *Bastin*. a) „Etudes philologiques de la langue française“. Pr. 80 c.; b) Etude philologique de la langue française ou grammaire comparée et basée sur le latin“. Pr. 1 r. 25 c.; c) „Etude philologique. Grammaire historique de la langue française“. Pr. 1 r. 25 c.; d) „Etude des participes“. Pr. 80 c.

68) *Fleury*. a) „Histoire élémentaire de la littérature française“. Pr. 1 r. 60 c.; b) „Extraits des meilleurs auteurs français par ordre chronologique“. Pr. 1 r. 60 c.

69) *Bastin*. a) „Aperçu de la littérature française“. Pr. 80 c.; b) „Chrestomathie littéraire. Morceaux de lecture“. Pr. 1 r.

70) *Fenoult*. „Chrestomathie française“. Pr. 1 r. 35 c.

71) *Anspach*. „Nouvelle chrestomathie française. Extraits des meilleurs écrivains en prose et en vers“. Pr. 2 r.

72) *Levrier* et *Demmenie*. „Narrations et exercices de mémoire en prose et en vers“. Pr. 75 c.

73) *Fleury*. „Narrations and descriptions selected from the best Russian authors, for translation into French“. Pr. 40 c.

74) *De la Droitière*. „Book of translations from Russian into French“. 2 parts. Pr. 1.60.

75) *P. N.* a) La veillée de Vincennes par le comte Alfred de Vigny“. Pr. 45 c.; b) „La bataille de la Moscova par le général comte de Ségur“. Pr. 45 c.; c) „Sous la tonnelle par Emile Souvestre“. Pr. 45 c.

76) *Ignatovitch*. a) „Corneille. Le Cid. Horace“. Pr. 1 r.; b) „Racine. Esther. Athalie“. Pr. 1 r.; c) „Molière. L'avare. Le misanthrope“. Pr. 1 r.; d) „Molière. Le bourgeois gentilhomme. Les femmes savantes“. Pr. 1 r.

77) *Alexeef*. a) „Xavier de Maistre. Prascovie ou la jeune sibérienne“. Pr. 60 c.; b) „Emile Souvestre. Au coin du feu“. Pr. 40 c.; c) „Voltaire. Histoire de Charles XII“. Pr. 40 c.; d) „Thiers. Napoléon à Sainte Hélène“. Pr. 40 c.; e) „Molière. Le misanthrope“. Pr. 60 c.

78) *Flint*. „Michaud. Histoire de la première croisade“. Pr. 1 r.

79) *Louis Goerst*. „Voltaire. La bataille de Poltava. Pr. 30 c.

80) *Kreisberg*. „Scribe. Le verre d'eau“. Pr. 45 c.

81) *Mambré*. „Xavier de Maistre. Les prisonniers du Caucase“. Pr. 60 c.

82) *Makaroff*. a) „Dictionnaire français-russe complet“. Pr. 5 r. b) „Dictionnaire russe-français complet“. Pr. 5 r.

b) *German language*:

83) *Golotuzof*. „German alphabet adapted to the method of a simultaneous teaching of reading and writing“. Pr. 30 c.

84) *Tiwass*. „Elements of the German language“. Conversation, reading and writing. Pr. 60 c.

85) *Mey*. „Lesebuch für russische Real- und Töchter-Schulen“. Pr. 2 r. 90 c.

86) *Moritz Oertel*. „Hilfsbuch zum practischen Unterricht in der deutschen Sprache“. Pr. 75 C.

87) *Keiser*. „Brief German grammar“. 3 parts. Pr. 2.30.

88) *Mey*. „Brief German grammar“. Pr. 80 c.

89) *The same*. „Grammatic tables of the German language“. Pr. 40 c.

90) *Hofmann*. „Syntax of the German language, explained comparatively with the syntax of the Russian language“. Pr. 75 c.

91) *Hoheisel*. „Deutsche Grammatik für höhere Unterrichtsanstalten“. Pr. 1 R.

92) *Müller*. „Deutsches Lesebuch für Schulen in Russland“. Pr. 1 R. 20 C.

93) *Masson*: a) „Musterstücke“. Pr. 75 C.; 6) „Lesestücke“. Pr. 75 C.

94) *Sturtzel*. „Book of exemplary articles in the German language“. 2 parts. Pr. 2.50.

95) *Nedler*. „Book of remarkable works of the german classic literature“. Pr. 1 r. 50 c.

96) *Belitzki*. „German christomathy“. Pr. 2 parts. 2 r.

97) *Zeidler & Preiss*. „Book of German poems“. Pr. 65 c.

98) *Oertel*. „Articles for translating from Russian into German“. Pr. 60 c.

99) *Masson*. „Manual for exercises in translations from Russian into German“. Pr. 75 c.

100) *Keiser*. „Collection of articles for translation from Russian into German“. Pr. 1 r.

101) *Booch & Frei*. „Pocket-dictionary“ (Russian - German & German-Russian). Pr. 3 r.

36) Physics.

The collection exposed is chiefly formed of implements, either independently proposed by Russian scientists and teachers of physics or varied by them according to the requirements of Russian schools. The implements, representing nothing new, are exposed as samples of Russian manufacture.

37) Experiments with electricity and magnetism.

102) The collection of implements for such experiments is made by Richter according to the indication of Mr. *Kolbe*, teacher at the St. Petersburg Anne school. Price 62 rbs. The collection consists of: a) two electrosopes with two paper leaves; b) a conductor; c) attributes for experiments with electrosopes: pin, hooks, wire with an isolated handle, ebony stick with pith-balls, discharger; d) electrometer with an aluminium leaf and condensator; e) attributes

for electrometrical experiments: a hollow ball, projection scale, electric safety net, rod with a paper leaf, four coal-zinc batteries.

103) Electrometer for atmospheric electricity, made by Richter according to Mr. *Kolbe's* instructions. Pr. 35 rbs.

104) Electroscope of *Borgmann*, Prof. at the St. Petersburg University. Pr. 20 r.

105) A pliable net for the demonstration of the distribution of electricity on the conductors; made by Richter according to the instructions of Mr. *Kolbe*. Pr. 8 rbs.

106) Galvanometer made by Frantzen from the drawing of Mr. *Lermontof*, laboratorist. of the St. Petersburg University. Pr. 150 rbs.

107) Tangent galvanometer constructed by Richter according to data of Prof. *Petrushevsky*, of the St. Petersburg University, and modified by Prof. *Borgmann*. Pr. 125 rbs.

108) Demonstrative sine-tangent compass for the demonstration and measure of strong currents by the method of Obach. Made by Richter. Price 50 rbs.

109) Voltmeter Berten. Made by Frantzen from *Lermontof's* drawing. Pr. 25 rbs.

110) Diomagnet apparatus of Faraday with copper pendulum for the demonstration of Fuko's currents. Made by Richter. Pr. 450 rbs.

111) Fuko's apparatus showing: a) the fusion of easily fusible metal in its rotation in the magnet field, and b) the heating of the copper circle turning in the magnet field. Made by Richter. Pr. 250 rbs.

112) Model of Gramm's dynamo-electric machine, with Gramm's ring. The model is made according to *Rosenberg's* system, teacher in a gymnasium at St. Petersburg, by Richter. Pr. 15 rbs.

113) Apparatus for the direction of electric currents by terrestrial magnetism. Made by Richter. Pr. 80 rbs.

114) Inclinator and declinator with divisions on the horizontal and vertical circles, micrometrical motion, 2 levels and 3 levelling screws. Made by Richter. Pr. 75 rbs.

38) Implements for experiments „in light“.

115) Universal light implement for various experiments, made by Richter according to the indications of Rosenberg. Price 175 rbs.

116) A cube of the form of a small box; implement for the explanation of the phenomenon of a full interior reflection; made by Richter according to Rosenberg's indications. Pr. 3 rbs.

117) Implement for the demonstration of phenomena of the relative coefficient of refraction; made by Richter. Price 35 rbs.

118) Implement for the explanation of the origin of the colors of opaque bodies; made by Richter according to Rosenberg's indications. Pr. 20 rbs.

119) Implement for the demonstration of the blending of stained rays and material colors (for the explanation of the theory of Helmholtz); made by Richter according to Rosenberg's indications. Price 25 rbs.

120) Colorimeter of Kolbe; made by Richter. Price 25 rbs.
The implement serves for the demonstration of the blending of colours and for a quantitative definition of color blindness.

121) Photometer of Prof. Petrushevsky; made by Frantzen. Price 30 rbs.

122) Projection camera. It can be employed with the regulator of the electric light or with the drummond burner; made by Richter. Price 250 rbs.

123) Electric light regulator. Price 125 rbs. and Cock-stop for the drummond light. Pr. 23 rbs.

124) Board with 5 chinks and frames, with red glasses on one side and blue ones on the other, for demonstrating on a screen the crossing of rays through the lenses and the reflection of the rays in the mirror made by Richter. Price 25 rbs.

39) Implements for experiments „in heat“.

125) Implement for the definition of the coefficient of expansion of solid bodies, by Lermontof's drawing; made by Frantzen. Price 20 rbs.

126) Caloriscopes, by Lermontof's drawing; made by Frantzen. Price 10 rbs.

127) Implement for the definition of latent heat, according to Lermontof's drawing; made by Frantzen. Price 35 rbs.

128) Psychrometer of August with ventilator; made by Richter. Price 45 rbs.

129) Missive psychrometer; made by Richter. Price 25 rbs.

40) Implements for experiments relating to other sections of the course of physics.

130) Atwood's machine, from the drawing of Van der Flitt, Professor at the St.-Petersburg University; made by Frantzen. Price 35 rbs.

131) Lermontof's Parallelogram of forces made by Frantzen. Price 8 rbs.

132) Dynamometer, from the drawing of Gesehus, Professor at the Technological Institute at St.-Petersburg; made by Frantzen. Price 7 rbs.

133) Professor Kraevitch's Barometers: cabinet — 50 rbs. and travelling — 75 rbs.; made by Richter.

134) Implement of Prof. Van der Flitt and Lermontof demonstrating the nature of gas; made by Frantzen. Price 36 rbs.

135) Sizer, from Lermontof's drawing; made by Frantzen. Price 50 rbs.

136) Implement for determining the number of vibrations of a tuning-fork; made by Frantzen. Price 32 rbs.

137) Lermontof's implement for determining the modulus of elasticity of twisting and tension, made by Frantzen. Pr. 75 rbs.

138) 7 models for the transformation of the rotatory motion into other various motions, of Chebishef, Academician in ordinary of the St.-Petersburg Imperial Academy of Sciences; made by Frantzen. Price 150 rbs.

The whirler and chair are made after the ideas of Prof. Chebishef, as models of practical adaption of the principles of the theoretical mechanics. The former costs 50 rbs. and the latter—100 rbs.

139) *Dubrovsky*. Physical implements for elementary schools and teacher-seminaries as well as for independent occupations of scholars of secondary educational institutions.

These physical implements substantially differ in their simplicity from those generally used. The simple construction of the implement simplifies also the phenomenon of nature provoked by it: the scholar, not distracted by the secondary details, more easily understands the essential of the phenomenon which he is learning. Simplicity in elementary experiments when studying nature is so obligatory, that it should be secured, if necessary, even by somewhat inexact experiments.

Dubrovsky's collection consists of the following 67 physical implements: 1) Stable, unstable, and uniform equilibrium. 2) Prism with a transpositive center of gravity. 3) Globe, ascending an inclined plane. 4) Self-ascending little case. 5) Body resting upon one point with the transpositive center of gravity. 6) Little case ascending an inclined plane. 7) Transmission of an impact by elastic bodies. 8) Floating body with a varying circumference. 9) Floating body with a varying weight. 10) Flask floating in cold and sinking in warm water. 11) Assay-pipe showing floating in salt and fresh water. 12) Transmission of sound waves in the air. 13) Resistance of air to the motion of bodies. 14—16) Expansion of solid bodies in heating. 17) Caloric capacity of water, iron and lead. 18) Heat conductivity of solid bodies. 19) Hygroscope. 20) Vessel for the study of radiant heat. 21) Elasticity of steam. 22) Centrifugal machine. 23) Compression of the earth due to rotatory motion. 24) Implement for studying the centrifugal force. 25) Vessel for the revolution of liquids. 26) Side pressure of liquids. 27—28) Implements for demonstrating the law of Pascal (Segner's wheel). 29—30) Implement and balls for demonstrating the law of Archimed. 31) Air pressure — rising of water in pumps. 32) Air pressure — fountain in discharged air. 33) Flask for weighing air. 34) Cylinder for the demonstration of the specific gravity of warm and cold air, hydrogen, and carbonic acid. 35) Implement for the reflection of light. 36) Implement for drawing the course of the rays of light in prisms. 37) Rectangular water prism transformable into a rhomboidal one. 38) Empty lens for immersing into water. 39) Implement for a full interior reflection of light. 40) Vertical prism for liquids. 41—42) Implements for the refraction of light. 43) Implements for the heat conductivity of liquids and also for the emission and absorption of heat in various cases. 44) Magnetic needle. 45) Electric needle. 46) Side pressure of liquids. 47) Action of electricity through influence. 48) Differential thermometer. 49) Distribution of electricity on the surface of the conductors. 50) Franklin's wheel. 51) Electric machine. 52) Combustion of sulphuric ether by an electric spark. 53) Missive action of an electric spark. 54) Model of a telegraphic type-writer. 55) Electric plume. 56) Leyden jar and discharger. 57) Distribution of electricity upon the surface of the conductors. 58) Mirror on a pedestal for various experiments in light. 59) Convex and concave lenses for liquids. 60) Shutter for a magic lantern.

61) Celestial globe. 62) Guiding table in setting the celestial globe, according to a given latitude. 63) Real and visible motion of the planets: Venus, Earth and Mars. 64) Annual motion of the earth—change of seasons. Rotation of the moon round its own axis and round the earth. 64) The moon's and sun's eclipses. 65) Explanation of the phases of Mercure, Venus, Mars, Saturn and the Moon. 66) Refractive action of the earth's atmosphere and 67) Instrument for the explanation of solar spots.

140) *Kraevitch*. „Manual of physics.“ Pr. 1.60.

141) *Kovalsky*. „Text-book of elementary experiments.“ Pr. 2.50.

41) Collection of topographical instruments.

The collection of topographical instruments is formed according to the course of topography in the military schools. In exposing the collection of these instruments the Pedagogic Museum chiefly intended to exhibit them as models of Russian manufacture. All the articles forming this collection are made by the optician and mechanic *Richter* at St. Petersburg.

142) Iron measuring chain with pins. Pr. 7.50.

143) Surveyor's protractor with scale. 5 rbs.

144) Protractor with a vernier. 25 rbs.

145) Schmalcalder's boussole. 15 rbs.

146) Pocket mining compass on a quadrangle plate. 15 rbs.

147) Miner's compass of Mining-Engineer Ivanof's system with diopters, for use on a support. 35 rbs.

148) Large miner's compass with adjustments. 100 rbs.

149) Plane-table of Reisig's system, with two boards, cover, compass, ruler with diopters, level, scale, and fork with a plumb-line. Pr. 85 rbs.

150) Small plane-table, of the system of Maximovitch, with board, cover, compass and ruler with diopters. Pr. 30 rbs.

151) Alidade with telescope and vertical circle. Pr. 100 rbs.

152) Small leveling instrument with mirror. 10 rbs.

153) Leveling instrument. Pr. 300 rbs.

154) Station staff sliding in 2—3 lengths: double, 15 rbs. and triple, 25 rbs.

155) Astrolabe on three regulating screws, with a micrometrical motion of the alidade, a telescope with a level, a rangefinder, and a whole vertical circle. Pr. 150 rbs.

156) Astrolabe moving upon a ball bearing. Pr. 65 rbs.

157) Astrolabe on three regulating screws, with a micrometrical motion and two levels. Pr. 85 rbs.

158) Woltman's mill for measuring the velocity of running water. Pr. 100 rbs.

42) Collection relating to natural history.

The elements of natural history are studied in four classes (III—VI), at two lessons a week. In order that the teaching of natural history be as use-

ful as it can and must be, a demonstrative course is followed, i. e. it is before all based on experiments and observations, made by the scholars independently or in the class under the control of the teacher. By so studying the phenomena and bodies of nature the scholar becomes gradually familiarized with the method of natural sciences and can, when leaving the school, continue an independent study of nature, and so enlarge his knowledge of the natural riches of his country.

The study of natural history is carried on with demonstrative implements of Russian and foreign manufacture. The articles forming this collection are all of local manufacture.

43) Anatomy and physiology of man.

159) Skeleton of man. Made by Kirilof, preparator at the anatomic museum of the St. Petersburg Imperial Military-Medical Academy. Price 30 rbs.

160) Skull of man, admitted to be taken into pieces. Pr. 40 rbs.

161) Model of a longitudinal section of a man's head; made at the work-shop Strembitzky at St. Petersburg.

162) Dried ligaments of a man's wrist; made by Kirilof. Pr. 6 rbs.

163) Model of a shoulder articulation; made by Strembitzky. Pr. 5 rbs.

164) Dried ligaments of a man's sole; made by Kirilof. Pr. 6 rbs.

165—173) Models of: a) articulation of the thigh bones with the pelvis, b) articulation of the tibia with the heel bone, 5 rbs., c) section of a man's brain,—from the interior side, 5 rbs., from the lower, 8 rbs., d) spinal cord of a man, 16 rbs., e) organ of sight, 35 rbs., organ of hearing, 35 rbs., f) mask of a man with an open mouth, 17 rbs, and g) model of a man's molar tooth, 15 rbs.; all made by the work-shop of Strembitzky.

174) Natural preparation of a woman's heart; made by Dr. Belousof. Pr. 30 rbs.

175) Model of a man's heart, by Strembitzky. Pr. 14 rbs.

176) Injected preparation of the heart in connection with the lungs; made by Kirilof. Pr. 18 rbs.

177—178) Models of: a) a man's throat, 12 rbs., b) man's lungs (with heart), 20 rbs.; both made by Strembitzky.

179—180) Injected preparations: a) group of digestive organs: liver, stomach, pancreas, spleen, and of the duodenum, 16 rbs. and b) of the kidneys in connection with the ureters and the urinary bladder. 8 rbs.; made by Kirilof.

181) Model of the histologic formation of the human skin; made by Strembitzky. Pr. 8 rbs.

44) Zoology.

182) A fox; stuffed by Prihodko, preparator at the museum of the St. Petersburg Imperial Academy of Sciences. Pr. 14 rbs.

183) Skeleton of a lynx. Price 35 rbs.

184) A squirrel; stuffed by Prihodko. Pr. 4 rbs.

185) Skeleton of a squirrel. Pr. 6 rbs.

- 186) Spinal vertebrae of a horse; made by Prihodko. Price 3.50.
 187) Hoof of a horse. Price 2 rbs.
 188) Skull of an ox. Price 10 rbs.
 189) Horn of a reindeer. Price 50 cops.
 190—193) Birds: a) golden eagle with prey, 18 rbs., b) wood-cock, 8 rbs., c) bittern, 5 rbs. d) a duck, 5 rbs.; stuffed by Prihodko.
 194) Skeleton of a plover; 4 rbs. By Prihodko.
 195) Model of the stomach of a goose. By Strembitzky. 6 rbs.
 196) Skeleton of a turtle. By Prihodko. Price 6.50.
 197) Model of a serpent's heart. By Strembitzky. 25 rbs.
 198) Skeleton of a frog. By Prihodko. 3 rbs.
 199) Stages of development of a frog. By Strembitzky. 25 rbs.
 200) Organs of the circulation of blood of a frog. 8 rbs.
 201) Model of the organs of respiration of a frog. 22 rbs.
 202) Skeleton of a perch. By Prihodko. Price 5.50 rbs.
 203) Model of the heart and of the circulation of the blood of a fish (carp). By Strembitzky. 22 rbs.
 204—205) Cuttle-fish, 4 rbs.; its eggs (both in spirits), 3 rbs.
 206—210) Models of the mouth of: a) insects having jaws. Pr. 18 rbs., and b) of insects having sucking tubes (suctorial insects), Pr. 18 rbs., legs of an insect., 10 rbs., caterpillar, chrysalis and cocoon of a silk-worm moth, 18 rbs., head and breast of spider. Pr. 18 rbs. Made by Strembitzky.
 211—219) In spirits: a) Spider, pr. 2 rbs., b) tarantula, pr. 3 rbs., c) european scorpion, pr 7 rbs., d) scolopendra, pr. 4 rbs., e) leech, pr. 1 rb., f) ascaris, pr. 2 rbs., g) sea urchin, pr. 3 rbs., h) star-fish, pr. 1 rb., and i) medusa, pr. 7 rbs.

45) Botany.

- 220) *Uskof.* Herbarium consisting of: a) 38 species of the ordinary plants of the Russian flora and b) of a preparation relating to their organography. Pr. 20 rbs.
 221—222) Models of flowers of: a) sweet-peas, pr. 28 rbs., and b) lily, pr. 26 rbs.
 223) Model of the section of a pistil showing the stigma with the pollen-tubes. Pr. 12 rbs.
 224—225) Models of the germination of: a) bean, pr. 18 rbs.; b) wheat-grain, pr. 15 rbs.
 Models under № 221—225 are made by Strembitzky.
 226) Krutitzky's apparatus, intended for the culture of flowers in ordinary conditions. Pr. 30 rbs.
 227) Krutitzky's apparatus showing the effect of red and yellow light on the decomposition of carbonic acid, and emission of oxygen at an artificial lighting. Pr. 25 rbs.
 228) Diosmometer of Krutitzky. Pr. 12 rbs.
 229) Krutitsky's apparatus showing the quantity of water leaking out of plants. Pr. 15 rbs.

230) Apparatus of Volkof and Meyer (for experiments in respiration). Pr. 18 rbs.

231) Eudiometer (small). Pr. 6 rbs.

232) The same (large). Pr. 8 rbs.

46) Inorganic kingdom.

233) Collection of glass and wooden models of crystallographic forms; made by Krinitzin. Pr. 30. 50.

234) Collection of minerals, metals and ores; arranged by Kirpotenko, teacher at the Alexander Corps of cadets.

235) *Fedorof*. Implements demonstrating the symmetrical figures of crystallography and geometry. Pr. 150 rbs.

236) *Fedorof*. Brief manual of crystallography. Pr. 1. 50. Elements of figures. Pr. 5 rbs.

47) Independent occupations of scholars.

237) Automatic trap for catching insects (with bait). Pr. 7 rbs.

238) Automatic trap for catching nocturnal insects (with light). Pr. 7 rbs.

These two traps are made after the drawings of Kirpotenko.

239) Implements for summer occupations of scholars in natural history:

a) instruments for skeletonizing, arranged by Voronetzky, teacher at the Alexander Corps of cadets; pr. 15 rbs., and b) implements for natural-historical excursions, formed and collected by Kirpotenko, teacher at the same school; pr. 16 rbs. 55 ceps. Made by Kanaef's work-shop.

240) Collection of 58 birds of the Orenburg Government, arranged by Zarudni, teacher at the Orenburg Corps of cadets. Pr. 150 rbs.

241) Ores and minerals, collected at Krivoi Rog (Gov^t of Ekaterinoslav) by two cadets of the Alexander Corps.

242) *Kirpotenko*. Text-book for the study of nature. Arrangement of natural-historical collections.

48) Manuals and atlases.

243) *Jassinsky*. „Manual of Zoology“. Pr. 2 rbs.

244) *St. Iller*. „Elementary course of Zoology“. Pr. 1. 20.

245) *Raevsky*. „Primary course of botany“. Pr. 75 ceps.

246) *Brandt*. „Elements of natural history“. Parts 1—4. Pr. 4. 60.

247) *Gerd*. Text-book of mineralogy for Real-gymnasiums; 1. 50.

Manual of mineralogy for public-schools. 2 parts. Pr. 0. 80 c.

248) *Kirpotenko*. „Elementary Botany“. 1. 50.

249) *Anikief*. „Manual of the anatomy and physiology of man and of animals, with a brief sketch of the life-activity of plants“. Pr. 1. 25.

250) „The construction of a human body“. Chromolitographical drawings of the interior parts and organs and their respective disposition. Published by Fenoult. Pr. 1. 50.

251) *Jivotovsky*. „Botanic atlas“. 2 vols. Pr. 6 rbs.

49) Collection relating to geography.

The collection represents a systematic selection of the best geographical text-books employed in Russian educational institutions. It consists of implements, maps, atlases, models, illustrated journals and of other things, showing the works of Russian authors and manufactures of Russian work-shops and clearly explains the method of teaching of geography in our schools.

As the course of studies in geography is divided with us into three sections: a) primary course, b) universal geography and c) geography of Russia, the articles of the collection are arranged conformably to such division.

Primary course.

252) Globe of slate. Pr. 10 rbs. 85 c.

253) *Iljin*. Globe. Pr. 21 rbs.

254—259) *Michailof*. A mask of gypsum and its drawing, b) a clay model for the explanation of geographical terms, c) Plans of the class and of the school-building, d) suburbs of the school, e) vicinities of St.-Petersburg, and f) school-plan of St.-Petersburg.

260) *Iljin*. Plan of St.-Petersburg. Pr. 2 rbs.

261) St.-Petersburg from a bird's-eye-view.

262) *Meder*. School geographical atlas. Primary course. Pr. 2. 50.

263) *Iljin*. Wall physical map of European Russia. Pr. 2 rbs.

264) *Voronetzky*. Mercator map of the 5 parts of the world. Published by *Iljin*. Pr. 2 rbs.

265—266) *Iljin*: a) Wall mercator map of all the parts of the world and Australia, 1 rb., and b) Map of hemispheres. Pr. 1 rb.

267) *Shindhelm*. Ethnographic types in tables: a) heads (5 tables) at 15 rbs. per table, b) statuettes, 12 rbs. a table.

268) *Iljin*. Types of human races (1 table). Pr. 85 ceps.

269) *Jivotovsky*. Wall tables of the principle phenomena in the region of physical geography, with text. Pr. 12 rbs.

Course of universal geography.

270—271) *Iljin*. a) Physical maps of Europe, Asia, Africa, North America, South America, pr. 5. 90, and b) Wall maps of Europe, pr. 7. 10.

272) *Pulikovsky*. School geographical atlas, showing the methods of map-drawing in the class. Pr. 2. 50.

273) *Iljin*. School geographical atlas. Pr. 1. 50.

274—275) *Linberg*. a) Atlas of universal geography, with drawings; pr. 4. 50, and b) Short school-atlas of universal geography, pr. 1. 50.

Course of the geography of Russia.

276) *Iljin*. School atlas of Russia. Pr. 1. 50.

277) *Poddubni*. School atlas of Russia. Pr. 1 rb.

278) *Linberg*. Wall map of European Russia. Pr. 5. 25.

279—281) *Iljin*. a) Wall political map of European Russia. 2 rbs., b) Map of Russia in Asia, 2 rbs., and c) ethnographical map of Russia, pr. 5 rbs.

282) *Tchuslavsky*. Map of soils of European Russia. Pr. 15 rbs.

Implements used in studying geography.

283) *Shindhelm*. Types of races in busts: Europe, Asia, Africa, America; pr. of each bust: a) small size, 1 rb., b) middle size, 3 rbs. and c) large size, 10 rbs.

284) Types of tribes in figures: Asia, Africa, America, Australia; pr. 6 rbs. per figure.

The implements serve chiefly for the primary geographical course.

285) *Shindhelm*. Types of races in Russia. Pr. 3 rbs. per figure.

286) Types of some races of Russia; of common manufacture. Pr. 1. 50 a figure.

This collection is used in the study of the geography of Russia; it is also employed in passing the primary course in order to acquaint the scholars with the chief races inhabiting Russia.

287) *Mihailof*. Repetition maps and atlas.

288) Mineralogical collection for the school-course of geography and samples of soils of the Russian Empire (from the collection of soils of Prof. Dokutchaeff of the St.-Petersburg University).

Section for lectures and inquiries.

289) *Petri*, Professor of the St.-Petersburg University. „Methods and principles of geography. Manual of the methods of geography“. Pr. 2 rbs.

290) „Peoples of Russia“. Illustrated Magazine. Published by *Iljin*. Pr. 9 rbs.

291) *Karasin*. „From Russian life“. 3 parts. Pr. 3 rbs. for each part.

292) *Voronetzky* and *Karasin*. „Over the Russian land“. Pictures and text. Published by the journal „Rodnik“.

293) *Pauli*. „Peoples of Russia“.

294) *Jilinsky*. View and types of the western Russian provinces.

295) *Voronetzky*. „Illustrated geographical Magazine“ for use when teaching geography and reading geographical works. Pr. 1 rb.

296—297) *Iljin*. „Complete atlas of all the parts of the world“. Pr. 25 rbs., and „Register-atlas of Russia“. Pr. 20 rbs.

Manuals.

298) *Meder* and *Shumigorsky*. „Manual of universal geography“ (primary course). Pr. 50 cops.

299) *Voronetzky*. „Manual of universal geography“. 3 parts. 1. 25.

300) *Jantchin*. „Outlines of universal geography“. 1. 80.

301) *Turchakovsky*. „Manual of universal geography“. 1. 70.

302—303) *Pulikovsky*. a) „Manual of universal geography“, 2. 10, and b) „Text-book of the geography of Russia“. Pr. 1 rb.

304) *Schtuzer*. „Manual of the geography of Europe, for the senior classes“. Pr. 80 cops.

305) *Baranof*. „Manual of the geography of Russia for the secondary educational institutions“. Pr. 50 cops.

306) *Lebedef*. „Manual of the geography of Russia“. Pr. 1 rb.

50) Collection relating to History.

The study of history in Corps of cadets is accompanied by the lecture of historical works and also demonstratively with maps, charts and atlases.

For this purpose foreign demonstrative appliances are very often used (maps of Kiepert, Bretschneider, designs of Langl, Launitz and others) as the publishing of charts, maps, etc. is still unsufficiently developed in Russia. These foreign editions do not enter this collection which consists of Russian editions only.

The collection is divided into three sections: the historico-geographical, consisting of historical maps and atlases; the culturo-historical, of historical drawings, copies, illustrated books with historical contents, and the section of text-books chiefly used in Corps of cadets and other schools.

Historico-geographical section.

307) *Dobriakof*. Maps: a) of eastern Europe in the middle of the IX century and of Russia during the period of appanage up to 1240. Pr. 2 rbs. b) of the Moscow and Litva Russia up to 1689; pr. 2 rbs. and c) of the Russian Empire from Peter I to the present time. Pr. 2 rbs. Published by Iljin.

308) *Zamislowsky*. „School-atlas in Russian history, with explanations. Pr. 5 rbs.

309) *Dobriakof*. „School atlas in Russian history, for secondary and primary educational institutions“. Published by Iljin. Pr. 70 cops.

310) *Pavlishchef*. „Historical atlas of Russia“. 2 vols. Pr. 4 rbs.

311) *Dobriakof*. „School atlas with drawings and tables“: a) in ancient history, 1. 20, and b) in mediaeval and modern history, pr. 1. 50. Published by Iljin.

312) *Zuef*. „Historical atlas“. Pr. 2. 50.

313) *Tvelkmeier*. „Historical atlas of the old, middle and modern Ages“. Pr. 4 rbs.

Culturo-historical section.

314) *Solovief*. „Historical album of the 1000 anniversary of Russia. Portraits of the Imperial House of Russia“.

315) *Verestchagine*. „Album of the Emperors of Russia. Pr. 6 rbs.

316) *Rojdestvensky*. „National History in illustrations. Pr. 20 rbs.

317) *Zolotof*. „History of Russia in illustrations“. Published by Dementjef. Pr. 1. 50.

318) *Zemtzeff*. „Illustrated Russian History“. Artistic album. 1 rb.

319) „Fourty illustrations from the Russian history“. Pr. 2 rbs.

320) *Lushef*. „Historical albums“: a) portraits of renowned persons of the XVI—XVIII centuries, pr. 55 rbs.; b) Events of the reign of Peter the Great, views of places and buildings. Pr. 12 rbs. and c) contemporaries and co-operators of the Emperor Peter I. Pr. 15 rbs.

321) „Collection of portraits of personages“. 3 vols. Pr. 21 rbs.

322) *Antonovitch* and *Bets*. „Historical personages of the south-east of Russia with their photographs and biographies“. Pr. 6 rbs.

323) „Antiquities of the Russian Empire“; published by Imperial order. Pr. 200 rbs.

324) *Filiminof*. „Description of the ecclesiastical and civil state by memorials of antiquity at the Russian Museum of P. Korobanof“. Pr. 8 rbs.

325) *Count Tolstoï* and *Kandakof*. „Russian antiquities in the monuments of art“. Pr. 4 rbs.

326) *Strekalof*. „Russian historical costumes from the X—XIII centuries“. Pr. 23 rbs.

327) „Monuments of antiquity in the western Governments of the Empire“, in 2 books.

328) *Snegiref*. „Historical and archeological description of Moscow“. 3 vols. Pr. 10 rbs.

329) *Sipovsky*. „Native antiquity“. 3 parts. Pr. 6 rbs.

330) *P. Polevoy*. „Sketches of the Russian history“. Pr. 6. 75.

331) *Fabritzius*. „The Kreml at Moscow“. Pr. 9 rbs.

332) *Pyljaef*. a) „Old Moscow“. 9 rbs.; b) „Old Petersburg“. 3 rbs.

333) *Brückner*. a) „History of Peter the Great“. 6 rbs. and b) „History of Catherine II“. 8 rbs. Published by Suvorine.

334) „The reign of the Emperor Alexander II“. 8 rbs.

335) „Coronation of the Russian Emperors, beginning from the Tsar Michael Fedorovitch to the Emperor Alexander III“. 10 rbs.

336) *Dubrovine*. „The National war“. Illustrated edition. 3 rbs.

337) *Hoppé*. „Illustrated chronicle of the war of 1877—78“. 12 rbs.

338) *Zahartchenko*. „Kief, now and formerly“. 7 rbs.

339) *Kemmerer*. „The Tsarskoé-Selo Arsenal“. 75 rbs.

340) *Tsibulsky*. a) „Tables for the demonstrative teaching and study of Greek and Roman antiquities“. 11 rbs. 25 c.; b) „The ancient town of Athenes and its port. 5 rbs. 75 c.

341) *Weisser*. „Illustrated atlas of the universal history“. 35 rbs.

342) *Herzberg*. History of Greece and Rome“. 2 vols. 9 rbs.

343) *Falké*. „Hellas and Rome“. 33 rbs.

344) *Plavaïsky*. „Outlines of Russian history“: a) Course of the senior age, 1 rb. and b) Course of the middle age. 40 c.

345) *Solovief*. „School-book of Russian history“. 1 rb. 25 c.

346) *Beliarminof*. „Elementary course of Russian history“. 50 cops.

347) *Ilovaïsky*. a) „An abridged manual of the universal and Russian histories“. 75 cops., b) „Manual of universal history“. „Old and Middle Ages, and the Modern History“. 3 parts. 2 rbs., c) „Manual of universal history“. 1 rb. 40 cops.

348) *Beliarminof*. a) „Manual of ancient history“. 70 cops. b) „Manual of mediaeval history“. 70 cops.

349) *Gurevitch*, a) „History of Greece and Rome“. 1 rb., and b) „Review of the chief events of the modern history by centuries“. 60 cops.

350) *Popof*. „Graphic table of the Russian history“. 50 cops.

351) *Ostrogorsky*. „Chronology of the universal and the Russian history“. 75 cops.

352) *Gurevitch*. „Historical comparatively - conspective tables in the modern and newest history“. 80 cops.

353) *Gé* and *Sokolovsky*. „The course of universal history“. 3 rbs.

354) *Piassetsky*. „Demonstrative table of universal history“. 3 rbs.

51) Collection relating to drawing.

The collection for the study of drawing consists of manuals and implements (published and made in Russia) adapted to the general educational course of drawing. The collection consists of implements: for drawing geometrical figures and their adoption to plane ornaments, drawing of gypsum ornaments and vases, and for the copy of landscapes.

355) *Redkovskaia*. „Manual for teaching elementary drawing.“ Pr. 1 rb.

356) *Smirnof*. a) „Wall tables for the teaching of elementary drawing, with explanatory text“, 5 rbs.; and b) book for teachers“, 1 rb.

357) *Galnbeck*. „A collection of 35 wall tables“. Pr. 15 rbs.

This collection is intended for exercises in drawing right lines of different directions, rectilinear figures and their various curves, symmetrical and unsymmetrical figures, complicated and simple styled leaves and flowers—with a short explanatory hand-book.

358) *Russanof*, teacher at the Alexander Corps of cadets. 11 wire models for the study of perspective reductions of plane figures.

359) *Ladnof*. a) Collection of 12 rotary models,—33 rbs. and b) Drawing of geometrical figures and bodies from wire models,—1.50.

360) Stand for wire models and wall tables. Pr. 25 rbs.

361) *Rjabkof*. „School of technical drawing, with explanatory note“. 2.40.

362) *Pavlof* and *Ivanof*. a) „Course of linear perspective“, — 1.25; b) „Drawings to it“, — 1.25.

363) *Gortof*. „Method of drawing“. 1 rb.

364) *Kreitan*. „Collection of gypsum ornaments“. 34 rbs.

The collection consists of 20 elementary ornaments, chiefly intended for the study of shading.

365) *Preobrajensky*. Three models for landscape drawing.

366) *Hmelnitzky*. „Method of landscape painting. — 60 cops.

367) *Shishkin*. „Drawings with coal“. 2 series, of 12 drawings each. Pr. 25 rbs.

These drawings serve as originals for exercises in drawing in the senior classes of Corps of cadets.

52) Collection relating to caligraphy.

The collection consists of copy-books, etc. used in Corps of cadets for the study of caligraphy.

368) *Akatof*. „Method of caligraphy“. 1.25.

369) *Pogearsky*. a) „Manual to the full course of Russian caligraphy and short-hand writing“, — 40 cops.; b) „Fundamental rule of caligraphy“, — 50 cops.; c) „Course of caligraphy and short-hand writing“, — 40 cops.

370) *Pogearsky*. „Modeles d'ecriture française“. Pr. 20 c.

371) *Pogearsky*. „Deutsche Vorschriften“. Pr. 20 c.

372) *Virenius*. „Rational method of writing according to recent researches“. Pr. 30 cops.

373) *Gerbatch*. a) „Methodic manual for the study of writing“, — 40 c.; b) „Round Russian characters“, — 40 c.; c) „Explanatory text to round characters“, — 20 c.; d) „Manual for the study of writing French-German characters“, — 35 c.; e) Manual for the study of writing Russian characters“, 40 c. and f) „Russian short-hand writing“, — 40 c.

374) *Zaitsef*. „Caligraphic album“. Pr. 2 rbs.

53) Collection relating to singing and music.

Singing and music belong to out-of-class occupations of the scholars of Corps of cadets.

The elementary exercises of singing, in connection with the first fundaments of the theory of music, are followed by all the cadets of the first two classes without complying with their voices and ear. From the third class all the cadets, with or without a changing voice and those with a good ear, are entered into the choir of the Corps. Exercises with this choir are followed by sections (either by classes or by voices) and by its general composition. Each separate section has not less than one lesson a week. Cadets with good voices and musical capacities compose the choir of the church of their school.

Those only study music who, besides capacities, have also shown some inclination for it. The instruments on which the cadets are taught to play belong to orchestra instruments in order to enable the scholars to play together in orchestres.

The collection in question is divided into 4 sections: a) Singing, b) Religious singing, c) Music and d) Manuals.

Singing.

375) *Brjansky*. a) „Manual of singing“, pr. 80 c., b) „Musical alphabet“, pr. 50 c.

376) *Rubetz*. a) „Musical alphabet“, pr. 75 c. and b) „Book of exercises“, 5 parts. Pr. 8 r. 25 c.

- 377) *Marenitch*. „Practical course of elementary singing“. Pr. 2 r.
 378) *Rubetz*. „Children songs“. Pr. 1 r. 50 c.
 379) *Brjansky*. „Book of songs for children“. Pr. 1 r.
 380) *Rubetz*. „Children songs for one voice“. Pr. 1 r.
 381) *Marenitch*. „School songs for one and two voices“. Pr. 80 c.
 382) *Rubetz*. „Book of school chorus songs for two similar voices“. Pr. 1 r. 50 c.
 383) *Melnikof*. „Book of chorus songs for junior classes“, 2 parts.
 Pr. 4 r. 40 c.
 384) *Brjansky*. „Book of songs for two voices“. Pr. 1 r. 50 c.
 385) *Marenitch*. „School chorus songs for three voices“. Pr. 75 c.
 386) *Brjansky*. Two operas for children: „The cat, the goat, and the ram“
 and „The musicians“. Pr. 3 r. 50 c.
 387) *Melnikof*. „Book of chorus songs for the tenor part.“, 2 parts.
 Pr. 4 r. 50 c.
 388) *Rubetz*. „60 russian popular songs“. Pr. 1 r. 50 c.
 389) „Russian popular songs in one copy-book“. Pr. 2 r. 90 c.
 390) *Wessel* and *Albrecht*. „Book of soldier, cossack and sailor songs.
 Pr. 1 rb.
 391) *Brjansky*. „Chorus songs for 4 voices. Pr. 50 c.
 392) *Melnikof*. „Book of chorus pieces for a choir“. 2 parts. Pr. 4 r. 50 c.
 393) *Vorotnikof*, *Derfeldt* and *Rubinstein*. „Songs for many voices“.
 Pr. 2 r. 30 c.
 394) *Rubetz*. Popular song: „Down the river Volga“. Pr. 75 c.
 395) *Chaikovsky*. Chorus „Nightingale“. Pr. 70 c.
 396) „Pieces for chorus singing“. 2 copy-books. Pr. 11 r. 30 c.
 397) „Chorus' from russian operas“. Pr. 9 r. 25 c.

Religious-singing.

- 398) *Bachmetief*. „Notes for church singing arranged for 4 voices“. Partition in 2 parts, and for separate voices in 8 vols. Pr. 30 rbs.
 399) *Lvof*. „The first verses of sunday and holiday hymns“. Pr. 4 rbs.
 400) *Lamakin*. „Religious-musical works“. Pr. 5 rbs.
 401) Archpriest *Turchaninof*. „Collection of religious-musical works“. Pr. 3 r.
 402) *Bortnjansky*. „8 religious trio“ (for two sopranos and one counter-tenor). Partition and separate voices. Pr. 4 r. 20 c.
 403) *Bortnjansky* and *Lvof*. „Religious pieces“ for religious singing in military educational institutions. Pr. 3 r. 10 c.
 404) *Rojnof*. „Book of religious-musical pieces“. Pr. 8 rbs.
 405) „Ancient airs for a choir of four voices“. Pr. 3 r. 10 c.

Musical instruments, manuals.

- 406) Collection of musical instruments: Piccollo-flute—15 r., flute—60 r., clarinet Es—45 r., clarinet B—45 r., cornet-a-piston—50 r., waldhorn F—60 r.,

althorn Es—50 r., tenorhorn B—60 r., baritone B with 4 pistons—80 r., bass Es—100 r., trombone B—50 r., big drum—50 r., small drum—30 r., cymbals—20 r., triangle—3 r., 2 violins—13 & 35 r., viola—19 r., violoncello—39 r., counter-bass—55 r., clarinet A—45 r. The instruments were made by the firm Julius Heinrich *Zimmerman* at St.-Petersburg.

407) *Bagantz*. „School for violin“. Pr. 3 r.

408) *Albrecht*. „Practical elementary school for violin“. Pr. 2 r.

409) *Berio*. „School for violin“. Pr. 4 r.

410) *Resvetzof*. „Scales for violin“—2 r., and „Methodical elementary school for the violin“—3 r.

411) *Afanasief*. „Violin exercises“. Pr. 1 r. 75 c.

412) *Popof*. „School of technics for the violin“. Pr. 75 c.

413) *Grjimali*. „Scale exercises for the violin class“. Pr. 2 r. 20 c.

414) *Jigardlovitch*. „Manual for developing the mechanism of violin playing“. Pr. 2 r.

415) *Degtjaref*. „Automatic implement for teaching violin playing“. Pr. 7 r.

This implement, in habituating the scholar to a correct position of his body and left hand, enables also his right hand to develop a mathematically exact motion.

416) *Kummer*. „Violoncell-schule“. Pr. 2 r. 50 c.

417) *Dotzauer*. „Violoncell-schule“. Pr. 1 r. 20 c.

418) *Li*. „Violoncello-school“. Pr. 4 r.

419) *Kaiser*. „Nouvelle méthode d'alto“. Pr. 1 r. 80 c.

420) *Jdanof*. „Counter-bass school“. Pr. 5 r.

421) *Richter*. „Contrabass-Schule“. Pr. 1 r. 35 c.

422) *Keller*. „Flute-school“. Pr. 2 r. 50 c.

423) *Kummer*. „Flute-school“. Pr. 1 r. 50 c.

424) *Chiardi*. „Flute-school with 125 russian songs to it“. Pr. 6 r.

425) *Kitzer*. „Clarinet-school“. Pr. 4 r.

426) *Bagantz*. „School for Cornet-a-piston“. Pr. 2 r. 50 c.

427) *Thomsen*. „School for Cornet-a-piston“. Pr. 4 r.

428) *Kling*. Schools for the „voltorn, althorn and trombone“, pr. 2 r. 25 c., and schools for the hautboy, bassoon, clarinet and counter-bass. Pr. 5 r. 50 c.

429) *Turner*. „Elementary-school for brass instruments“. Pr. 4 r.

430) *Bagantz*. „Practical-school for the trombone. Pr. 5 r. 60 c.

431) *Albrecht*. „Russian songs arranged for the violin“. Pr. 1 r. 50 c.

432) *Bagantz*. „Book of easy duets for two violins“. Pr. 75 c.

433) *Waterstraat*. „40 études pour la flute“. Pr. 2 r.

434) *Bagantz*. „Orchestra for scholars of Corps of cadets“. Pr. 3 r.

435) „Collection of musical pieces for string orchestras“. 4 books. Pr. 73 r. 35 c.

436) „10 pieces for a Cadet band“ (from the repertory of the 2-nd Corps of cadets). Pr. 18 roubles.

54) Collection relating to school hygiene.

This collection relates to the hygiene of military-educational institutions, and consists of: a) the plans of the buildings of two Corps of cadets: of the Don—at Novocherkask and of the 1-st Cadet Corps of St.-Petersburg, b) articles, respecting the hygiene of a cadet: his clothes, linen, boots, and food allowance (in tables); c) diagrams of diseases and deaths in military-educational institutions for twenty years and d) diagrams of the physical development of children in secondary educational institutions of Moscow.

In presenting the plans of the above two Corps of cadets, the Pedagogic Museum of the military-educational institutions had the following in view: the building of the Don Corps was built only 8 years ago according to the contemporary requirements of the art of building and of school hygiene whereas the 1-st Corps of cadets (at St.-Petersburg) was constructed in the first half of the XVIII century and not for educational purposes and, therefore, its plans show those capital repairs which had been made in order that it may answer the contemporary hygienic conditions of schools.

The diagrams of the physical development of children, however not relating to the physical development of scholars of military-educational institutions, nevertheless entered this collection as a result of researches having a general pedagogical interest.

437) Plans of the building of the Don Corps of cadets at Novocherkask and of that of the 1-st Corps at St.-Petersburg.

438) Photographic views of the building of the Don Corps of cadets at Novocherkask.

439) Forms of clothes, linen and boots of the cadets, on two lay-figures.

440) Table of food allowance to cadets.

441) Table of the quantity of nutritive values in a day ration of cadets.

442) *Virenius*. School-tables and benches. Pr. 60 c.

443) *Dr. Demjankof*. Scheme, diagrams, diseases and deaths in military-educational institutions.

444) *Dr. Demjankof*. Medico-statistical report of the diseases and deaths in the military-educational institutions for ten years, from 1876 to 1885.

445) *Dr. Zak*. Diagrams of the physical development of scholars of the Moscow secondary-educational institutions.

446) *Dr. Zak*. The physical development of children in the Moscow secondary-educational institutions. Height and circumference of the breast.

55) Collection relating to popular lectures.

The initiative in the introduction in Russia of lectures (accompanied by demonstrative pictures reproduced with a magic lantern), for soldiers and the people, belongs to the Pedagogical Museum of the military-educational institutions. Since 1871, when these lectures first took place in the auditory of the Museum, over 1000 lectures had been written for their recitation in auditories

of soldiers and people; of this number of lectures 230 had been approved by the Committee of the Museum. The above collection consists of 2 lectures: the first entitled „Salt“ is a technical lecture, and the other „The Caucasian Captive“ is of military-literary contents. The colored pictures to these lectures were made by Mrs. Jivotovksy in the photographic pavilion of the Museum of applied sciences. The collection comprises also a sciopticon for the reproduction of the pictures on the screen, and 3 series of pictures prepared by: Mrs. Jivotovsky, Kanaef's Work-shop of educational implements and by Richter. The large number of pictures entering this collection are sent as samples by which one may judge the manufacture of pictures on glass in Russia.

447) Sciopticon for the reproduction of pictures on the screen, used by the troop sections. Made by Richter. Pr. 50 rbs.

448) *Shvedof*. „Salt“, a popular lecture, translated from Russian.

449) *Count Tolstoy*. „The Caucasian Captive“, a popular lecture translated from Russian.

450) 9 pictures to the „Caucasian Captive“; made by Mrs. Jivotovsky. Pr. 2 rbs.

451) 23 pictures to the lecture „Salt“. Made by Mrs. Jivotovsky:

1) Crystals of salt; 2, 3, 4, 5) cameras in Velitchka, 6) camera of Steinhäuser, 7) camera of Mihailovitch, 8) Monument to Ferdinand I, 9) iconostasis of salt, 10) mines in Velitchka, 11) Iletsk mines, 12) a salt desert, 13) extraction of salt from salt-water, 14, 15) graduation-houses, 16) salt lake, 17) Lake Elton, 18) Dead sea, 19) salt mining in the island of Cheliken, 20) Chokrak salt lake, 21) wagons with salt, 22) Bath-house at Staraia Russa, and 23) Fountain at Staraia Russa, Pr. 2 rbs. per picture.

452) 12 magic-lantern pictures. Made by Richter. Pr. 2 rbs. per picture.

453) 12 magic-lantern pictures. Made by the Kanaef's Work-Shop of educational implements. Pr. 2—3 rbs. a picture.

454) 6 magic lantern pictures. Made by Mrs. Jivotovsky. Pr. 2 rbs. a picture.

455) *Velitchko*, Lieutenant-General. Heliographs.

They serve to inscribe the time the sun was brightly shining and how long it was covered by the clouds. They are both based on the same principle: the solar ray, in penetrating into the camera through a narrow hole, falls on a photographic paper upon which it leaves its trace, clearly seen while the sun is shining and disappearing when the latter is veiled by the moving clouds.

Among the articles exposed by the Pedagogical Museum of the military-educational institutions, there are: a) Collection of physical implements, under № 36 (page 30), of the St.-Petersburg Firm „*O. Richter, optician and mechanic*“, and b) under № 406 (page 44) a collection of musical instruments of the Firm „*J. Zimmerman, musical instruments*“ — also of St. Petersburg.

Both these firms participate in the World's Columbian Exposition as private and independent exhibitors.

Contributors of the Pedagogical Museum of the military-educational institutions: *Chebyshev*, Academist in ordinary of the Imperial Academy of sciences; *Rosenberg*, Teacher at the St. Petersburg Classical gymnasium; *Kolbe*, Teacher at the Chief German school of the Lutheran church of St. Anne; *Dubrovsky*, Teacher at the Liteinaia gymnasium for girls; *Lermontof*, Laboratorist of the Imperial University of St. Petersburg; Mining-Engineer *Fedorof* and Lieutenant-General *Velitchko*.

E) Military-Medical Section.

In the Chief Military-Medical Department are concentrated orders respecting the security of health in all the sections of the military administration, the completion of troops and military hospitals with medical, pharmaceutic and veterinary officials and their supply with medical and surgical instruments, and also orders regarding the superintendence of the personnel of said Department.

For the maintenance of health in the troops, the Chief Military-Medical Dept. is bound to see that the number of hospitals and lazarets be sufficient and that they be established at places, convenient by their situation and healthy by their local conditions; to supervise the correct and successful treatment of patients; to conduct military doctors and to prevent diseases and their development by hygienic, medical and medico-police measures.

To the above Department a Military-Medical Scientific Committee is attached, which, as the highest consultative institution in the military-medical administration, discusses and decides all the most important questions relating to this section.

The Chief Military-Medical Department is under the immediate superintendence of the Chief Military-Medical Inspector.

The Military-Medical Institutions in Russia are the:

- a) Imperial Military-Medical-Academy, with: The clinical military hospital and the Michael Clinical hospital of Baronet Villjé;
- b) military assistant-surgeons' schools;
- c) stores for medicines and drugs;
- d) St. Petersburg Surgical-Instruments Manufactory;
- e) permanent military hospitals
- and f) the local lazarets.

The Military-Medical section is represented at the Exposition by:

X. The Chief Military-Medical Department (at St.-Petersburg).

56) Steam disinfection-chamber.

The disinfection chamber of the type worked out and accepted by the Chief Military-Medical Department was constructed at the St.-Petersburg Me-

tallic Works and represents an apparatus working by means of saturated, uninterruptedly running steam, with an extra-pressure of $\frac{2}{3}$ of an atmosphere.

The chamber forms a horizontal, welded, steel-cylinder, 6,5 millim. thick, 1,52 m. long and 0,915 m. in diameter, with an entrance at each end.

By the rapidity of its work the chamber, notwithstanding its small dimensions, fully satisfies the requirements of a field-hospital of 400—600 beds. As, a proper distribution of work enables the boiler to feed two such chambers, it was considered more expedient to provide even the largest hospitals with two of them instead of increasing the size of one.

The whole chamber, weighing about 20 quintals, can be transported in an assembled state. Both these conditions are not without importance when the chamber requires to be sent to distant places. It differs from other existing types by the great rapidity of its work. The heating of the chamber to 100° C. is done in about 2 minutes; 15 minutes later, the temperature reaches 100° C. even in the center of tightly bound woolen blankets, folded in 32 layers, and in the following 15 minutes it attains 112° C.

Thus, a thorough disinfection can be made in 32 minutes. As a matter of fact, however, a shorter term will be sufficient, as, in practice, there will be no necessity of forming such tight bundles of the objects to be disinfected as was done in the test with blankets.

If we admit that the time necessary for disinfection is 30 minutes, then even does our chamber work: twice faster than those of Geneste and Herscher, Washington-Layon and of Benham and Sons; $2\frac{1}{2}$ times faster than Budenberg's and Henneberg's; 4—5 times faster than Schimmel's and 6 times quicker than those formerly constructed by the Metallic Works.

The St.-Petersburg Metallic Works supply these chambers to the War-Department at 1.375 rubls. per chamber.

57) Field-laboratory for hygienic researches.

With the exception of the microscope, the apparatuses, instruments and utensils forming this laboratory, are packed up partly in drawers and partly in open immovable compartments enclosed in two wooden boxes, each 74 ctm. high, 60 ctm. long and 40 ctm. wide. The covers of the boxes are provided with joints; the removal of the plank, forming the anterior wall of the box, transforms the latter into a sort of cupboard with drawers and open compartments. These anterior planks, when removed, can be joined by means of catches and, if laid on the boxes, form a working-table.

In order to give the boxes a greater solidity, they are covered with basket-platting and are protected from rain and dust by solid leather-covers. Both boxes can be tied to each other by broad straps adjusted to the covers, and form then a double bag to be thrown over the saddle. The microscope is packed in a special leather haversack which is carried by the investigator himself.

Each box bears a label and is designated by the letters „A“ or „B“.

Box „A“ contains: I -- a thermostat, in which 100 test-tubes are packed; II -- 18 Petri's dishes, for cultures; III -- a box with bottles and jars for chemical reagents; it contains:

3 white-glass bottles,	without labels.	} of 120 cc. capacity.
3 orange-glass	„ „ „	
2 white-glass	„ labelled: Ammonia, Solution of indigo.	
4 orange-glass	„ „ Permanganate of potash, Ether, Chloroform, Nessler's solution.	
4 porcelain jars,	labelled: Peptone, Agar-agar, Caustic soda.	} of 30 cc. capacity.
5 bottles,	without labels, for dye-solutions.	
1 orange-glass	„ labelled: Iodine-zinc-paste.	
1 white-jar,	„ Corrosive sublimate	
1 white-glass bottle,	„ Anilin-oil.	
6 jars with dyes, . . .	„ Methylen-blue; Methyl-violet; Eosine; Gentian-violet; Bismark's-brown; Fuch sine.	} of 30 cc. capacity.
2 jars with glass rods:	for cedar and glove-oil.	

4 bottles of 120 cc., in a wooden case each, for sulphuric, nitric, muriatic and acetic acid, test-tube holder, forceps, litmus paper (in a tin case), balsam of Canada, 4 pipettes for dye-solutions, labels, 2 wax-pencils for writing on glass, wiregauze; IV--2 flasks, Kjeldal's, of 200 cc., 2 flasks, Mohr's, of 250 and 100 cc., 2 glass-funnels, small, 2 cylinders for petroleum lamp; V--apparatus for steam-sterilisation, according to Koch (in the apparatus are packed: 2 brass bottles for alcohol and benzine, 1 flask of 500 c.c., 4 Ehrlenmeyer's flasks of 150 c.c., 12 Ehrlenmeyer's flasks of 50 c.c. and 50 common corks), towels, gelatine, $\frac{1}{2}$ lb., 24 sheets of filtering-paper.

Box „B“ contains: I--desiccating-stove, resting on 4 stands, iron-box for sterilisation of glass slides, 10 glass slides, 10 glass supports, 2 cylinders for pathological specimens, 2 folding supports for test-tubes, benzine burner with a contrivance for its lighting, petroleum lamp with 2 burners, 2 collapsing brass tripods, waterbath, set of brass sieves, for sifting the samples of soil, brass stand, for filtering, with 2 rings, iron stand, with 2 rings, burette-holder and flask-holder, nest of glass beakers (8), 2 glass-funnels, aeolipile, benzine, Paquélin's, bellows, with $4\frac{1}{4}$ m. of india-rubber tubing, for estimating the quantity of CO_2 in the air, according to Pettenkofer, india-rubber tubing ($\frac{1}{2}$ lb.), glass tubes and rods, knife for peeling potatoes, scissors, crucible-holder, iron cup for sand-bath, 2 wire triangles with muffs, brushes for cleansing test-tubes and beakers, cork-drill, absorbent cotton; II--pipette, of 25 c.c., graduated to $\frac{1}{10}$ c.c., 6 pipettes, of 1 c.c., graduated to $\frac{1}{10}$ c.c., 3 burettes, of 30 c.c., graduated to $\frac{1}{10}$ c.c., 1 burette, of 30 c.c., graduated to $\frac{1}{10}$ c.c., with glass stopcock, 3 pipettes, graduated, of 5, 10 and 20 c.c., dephlegmator, Glynski's, Binks' burette, Budde and Bourton's hydrotimeter, scale, pair of tubes for wash-apparatus, 3 pinch cocks, Mohr's; III--threads' counter, single microscope, resting on a tripod, wooden triangle for horizontal plane, slide of plate-glass for it, Wolfhügel's apparatus for counting the columns, Vogel's spectroscope, set of instruments for dissecting microscopic specimens and making cultures and inoculations—it contains: 3 scalpels, 3 forceps, 2 scissors, 2 needle-holders, lancet-shapet and curved needles, spatula, razor, 3 pipettes and 6 platinum needles, soldered in glass rods), August's wet-and dry-bulb thermometer (with table), 100 object-slides, 100 cover-glasses; IV--3 areometers (0,7--1,0; 1,0--1,5; 1,5--2,0), 3 chemical thermometers, graduated to $\frac{1}{10}^\circ$, to 50° , 100° and 360° , 2 lacto-butyrometers, Marchand's, Bese-Herzfeld's apparatus for estimating the fusel-oil, thermometrographe, with magnet, Borodine-Kjeldal's apparatus, Scheibler's extraction-apparatus, chemical balance, with a set of weights; V--2 porcelain cru-

eibles, with covers, 4 room-thermometers (R.'s), 160 cork-stoppered glass tubes, for weighed chemical substances, spirit-lamp, Fresenius' exsiccator, barometer, holosteric, with tables, 2 evaporating dishes, 12 watch-glasses, with clamps, 3 glass-stoppered Mohr's cylinders, of 25, 100 and 500 c.c., graduated, Liebig's condenser, copper, Salleron's apparatus, for estimating the quantity of alcohol in wine, india-rubber stoppers ($\frac{1}{4}$ lb.).

XI. The Surgical-Instruments-Manufactory.

It was established in the second quarter of the XVIII century for the manufacture of surgical instruments for the army, hospitals, and other institutions of the War, Navy, and Civil Administrations. The instruments are made partly by machines and partly by hand-work.

The Manufactory, with 69 skilled hands in its employ, is supplied with a horizontal steam-engine of 20 H. P. Its work-shops have 19 polishing lathes; the smith contains 6 furnaces; the work-shop for nickel-plating has 6 large and 3 small basins. The steel used for the manufacture of instruments, and the saws employed by the Firm are supplied by Wilson, Anisson, Hackford & Co. The Manufactory participated in all the native and International Expositions and was awarded medals at the exhibitions of London in 1862, Paris 1867, London 1873, Vienna 1873, Philadelphia 1876, Belgium 1876. In 1891 about 63,425 rbs. worth of instruments were manufactured, the cost of materials being estimated at 20,764 rbs. At the present time, on account of large orders for new aseptic cases of instruments for all the army, the Manufactory is undergoing repairs, it will be lighted by electricity; its smith and work-shops are about to be considerably enlarged; a special work-shop will be formed for polishing and finishing the ebonite (hard vulcanized india-rubber) cases, and trunks; in fact it intends to manufacture surgical instruments chiefly by machinery.

Manufacture of the instruments. Following the purposes of *asepsis* in hospitals in time of peace as well as in time of war and endeavoring to facilitate the disinfection of instruments, the Chief Military-Medical Department has already long ago replaced the wooden handles of instruments by steel (stamped) hollow nickel-plated ones. Quite recently, in order to avoid the damage of instruments (rusting, precipitation of nickel-salts, etc.) which has been observed in the continuous keeping of the best Russian and foreign instruments, it was decided to fabricate *whole-forged instruments* (blade and handle being of one piece of steel). These instruments, now exposed, being somewhat heavier than those with hollow handles (viz: the amputating knife is heavier by 1.25 gm., the scalpel—by 0.25 gm., and so on), answer all the requirements of *asepsis* and of long-continued keeping. The instruments of the post-mortem cases are distinguished by handles soldered with a brass-alloy. The eye instruments remain with the same ivory handles.

Packing of instruments. In their packing the Chief Military-Medical Department was guided by the same principles of *asepsis*. It was decided, therefore, to make cases for pocket-cases and trunks for large aseptic cases (division, battalion, hospital) from such a material which would enable as well to disinfect them by their immersion into disinfecting liquids and hot soapwater as to clean them mechanically with

brushes and carbolized soap-solution. For such material, the *ebonite* (hard vulcanized india-rubber) was chosen.

58) Pocket-cases of surgical instruments.

Surgeon's pocket-case: 4 scalpels: broad, sharp-pointed, straight, sharp-pointed, straight blunt-pointed, 2 pair of straight and 1 pair of Cowper's scissors, 3 forceps torsion: Frikke's, with hooks and catch, dressing (surgeon's), 1 Bromfield's tenaculum (surgeon's), 1 catheter, silver, folding, 1 grooved director with aneurism-needle, 9 surgical needles, 2 grms. of ligature silk, 20 suture-pins.

Assistant-surgeon's pocket-case: 1 bleeding lancet, 1 vaccinator, scissors (assistant-surgeon's), 1 razor, 1 dissecting-forceps, 1 spatula, 8 needles, 2 grms. of ligature silk, 50 suture-pins.

Sister's of charity pocket-case: 1 cork-screw, 1 p. scissors (assistant surgeon's), 1 clasp-knife, dressing, 1 dissecting forceps, 1 spatula, 8 needles, 2 grm. of white linen threads.

59) Large aseptic cases:

Battalion's case of instruments in box No 1: *Upper trunk:* 1 amputating knife, medium; 1 amputating knife of Langenbeck; 1 hand-saw; 1 Bromfield's tenaculum; 2 resecting knives, blunt-pointed and straight; sharp-pointed; 1 large scalpel, with broad blade and a small one; 1 razor; 1 p. dressing scissors; 5 forceps of Péan; 1 bullet forcep, curved on the edge, 1 chisel, straight; long, 2 ctm. broad; 24 surgical needles; 50 suture-pins; 1 curved-trocar; tube, canula, shaft, for Dechamp's apparatus. *Lower trunk:* 1 Colin's saw; 1 probe; 1 aneurism-needle; 2 quadruple tenaculums, sharp-pointed; 1 blunt hook, broad (retractor); 1 bellock's tube; 1 double tracheotomy tube; 1 necrosis forceps; 4 forceps for teeth; 1 reflector, adjusted to a candle; 1 Bergmann's torsion forceps; 1 forceps toothed, with rounded blades; 1 wire-ring for chloroform narcosis, 1 measuring tape, 4 three-sided files, 1 whet-stone, american, in wooden case. *Metal case, small:* 3 catheters of Nélaton, 1 mandrin, 1 brush for cleaning tracheotomy-tubes.

Battalion's case of instruments in box No 2. *Upper trunk:* 2 amputating knives, 1 hand-saw, 1 Bromfield's tenaculum, 2 resecting knives, one straight, sharp-pointed and the other with a broad blade, 2 scalpels with broad blade, one large and the other small. *In seats:* Scissors: straight, Cowper's; 7 forceps: Péan's, large and small, Frikke's and a toothed one with rounded blades, 1 tenaculum, 2 Farabeuf's blunt hooks, 1 needle-holder, 24 surgical needles, 50 suture-pins, 2 grooved directors, awl, catheter, bullet-forceps, straight. *Lower trunk:* 1 raspator, 2 sharp spoons, one round, the other oval, 2 chisels, 1 resecting hammer, bone-holding forceps, 2 forceps for teeth, 1 double tracheotomy-tube, medium, 1 wire-ring for chloroform narcosis, 1 mouth-dilator (Ferguson's), 1 three-sided file. *Small metal case:* 3 Nélaton catheters, 1 mandrin, 1 brush for cleaning tracheotomy-tubes.

Supplementary instruments in box No 3. *Upper trunk:* 3 amputating knives, large, medium and Langenbeck's; resecting knives: 3 blunt pointed, 1 with broad blade straight, sharp-pointed; 1 scalpel, with broad blade, small; 2 forceps, bone cutting, curved on the flat, Liston's forceps straight, 1 drill-brace, 1 box with 12 drills, 1 trephine with 2 crowns, 1 brush for cleansing trephine, 1 trocar, with 4 needles, 1 mouth-dilator (Ferguson's), 1 tracheal dilator, De-la Bord's, 3 Aural speculums, fitting one into another. *Lower trunk—small:* 1 tenaculum, for tracheotomy; 3 scalpels for tracheotomy, broad, sharp pointed, blunt pointed, 4 long tenaculums, sharp, 4 Becker-Braun's

needles, with long handles, 72 curved surgical needles, 1 aneurism-needle, 1 catheter *à double courant*, 1 measuring tape, 4 forceps, toothed, with rounded blades, 2 large Péan's forceps, 4 large torsion forceps of Frikke; 29 torsion forceps of Frikke, 2 toothed forceps, with rounded blades, 6 straight and curved bullet forceps, 1 razor.

Supplementary instruments in box No 4. *Upper trunk:* 4 p. scissors, straight, 5 Cowper's and 3 Richte's, 9 different blunt hooks, 2 needle-holders, 1 Colin's saw, 1 chisel, 1 probe, 1 Bellok's tube, 72 surgical needles, 1150 suture-pins, 3 nose-dilators, 1 reflector, 4 three-sided files. *Lower trunk:* 5 clasp-knives and 5 p. scissors, dressing, 5 double tracheotomy-tubes, 6 Pravatz syringes, 4 wire-rings for chloroform-narcosis, copper wire, 31 surgical needles, 1 reflector, adjusted to a candle. *Metal case:* 3 oesophagus tubes, 1 oesophagus probe with sponge, 6 cylindrical and olive-shaped catheters, 8 Nelaton's catheters, 2 mandrins, 12 pigeon-feathers, 5 brushes for cleaning tracheotomy-tubes.

Supplementary instruments of the hospital case:

Box No 3. *Upper (eye-instrument) trunk:* Critchett's eyelid-holder, 2 pair of Cowper's and Critchett's scissors, Tichomiroff's forceps, toothed, hooked and cilia forceps for eye-operations, 1 Bowmann's probe, 12 surgical needles for eye-operations, 1 drum for testing instruments (ivory). *Lower trunk:* On stands: 1 stout tenaculum for tracheotomy, 3 scalpels for tracheotomy, 1 tracheal dilator, De la Bord's, 1 reflector, 2 quadruple tenaculums, 3 Pravatz's syringes, 4 clasp-knives, dressing, 1 p. scissors dressing, 2 forceps of Frikke, German silver.

Eye-instrument's box. Graef's spoon with cystotome, 1 spoon of Graef and Critchett combined, 1 probe, Becker's, with hook (aluminium), 1 scarificator, Demarre's, 2 knives, Graef's, 2 broad scalpels for eye-operations, 2 knives, lanceolated, 1 incision-needle, 1 cataract-needle, 1 strabismus hook, 5 tracheotomy-tubes, 3 p. of Cowper's scissors, 2 syringes, one Pravatz and the other of glass.

Large hospital metal case: Oesophagus-tubes, Catheters: 3 olive-shaped, 3 cylindrical and 8 Nelaton's, 1 elastic, 1 Oesophagus probe, with a sponge, 2 camel-hair pencils, 5 brushes for cleaning tracheotomy-tubes, 1 cauterizer, 3 mandrins, 12 pigeon-feathers.

Box No 4. *Upper trunk:* 2 amputating knives, one large and the other of Langenbeck, 2 resecting knives, one blunt-pointed and the other sharp-pointed, 1 pair of Richter's scissors, 2 quadruple tenaculums, 2 straight forceps of Liston and Luer, 1 drill-brace, 1 metal box with 12 drills, 1 trephine with 2 crowns, 1 brush for cleansing trephine, 4 trocars: with 4 needles, Frenckel's, Thompson's and of Weiss, 3 clamps, 1 mouth-dilator, 1 razor. *Middle trunk:* 2 needles, Becker-Braun's, 4 tenaculums; forceps: 3 dissecting, 11 torsion, Frikke's and 3 Bergmann's; 1 saw, 1 chisel, 2 probes, Bowmann's; 1 reflector, adjusted to a candle, 3 laryngeal speculums, round, 3 aural, 1 catheter *à double courant*, 1 measuring tape, of metal webbing, in metal case. *Lower trunk:* 2 forceps, Pean's, 2 p. scissors, straight, 1 elevator, 2 hand-saws, 2 forceps, Musée's, 4 bougies, lead Bénicque's, 1 nose-dilator, 2 wire-rings for chloroform narcosis, 110 surgical needles, 550 suture pins, 1 three-sided file.

60) Post-mortem cases of instruments:

Medical—(for sections and operations on cadaver) with 2 trunks. *Upper trunk:* 1 amputating knife, 1 Langenbeck's, 1 cartilage knife and resecting knives, 2 broad scalpels, 1 brain knife, 3 p. scissors, Cloquet's assistant-surgeon's and surgeon's, 2 hand-saws, 3 forceps: dissecting and torsion of Frikke, 2 probes, 4 tubes: Bellok's tube, single tracheotomy-tube, tubes for injections, 2 aneurism-needles and a quadruple tenaculum, 1 raspatory, 1 magnifying lens, mounted. *Lower trunk:* 1 dissecting saw, 1 rachiotome, 2 chisels, 1 dissecting hammer, 5 tenaculums: Bromfield's, quadruple, blunt, 2 tooth

forceps, 12 dissecting needles, Weber's compass, 1 scale, 1 measuring tape, 1 measure, graduated of 3 oz., 1 whet-stone, american, 1 catheter.

Veterinary: 2 Langenbeck knives and 1 cartilage, 2 large broad scalpels, 2 pair of Cloquet scissors and one pair of large ones, 1 dissecting saw, 1 dissecting chisel, 1 rachiotome, 1 dissecting hammer, 2 dissecting forceps, 6 dissecting needles, 4 hooks, 2 probes one small and one with head, Weber's compass, 1 scale, 1 measure, graduated of 3 oz.

61) Veterinary cases.

Veterinary surgeon's haversack: 2 tenotomes, 1 knife for hoofs, Cowper's scissors, 2 quadruple tenaculums, aneurism-needles, seton-needle, 1 trocar for drainage, and one for puncturing the gut, exploring forceps, for hoofs and forceps for bullet, 2 probes, 1 syringe of Pravatz, 2 tin syringes, with 2 nozzles, 1 reflector with 2 handles, 1 magnifying lens, mounted.

Veterinary assistant-surgeon's haversack: 1 knife, for hoofs, 1 mouth-dilator, 1 tooth-rasp, 1 bullet-forceps, 3 syringes: one tin, the second of ebonite, for wounds, and the third for enemas, 1 catheter, 1 irrigator.

Veterinary pocket cases. *Surgeons:* 1 knife for hoofs, 4 broad scalpels, 1 onkotome, scissors, forceps: dissecting, torsion of Frikke, 2 tenaculums of Bromfield, 1 aneurism-needle, 1 trocar, 3 probes, 7 surgical needles, 2 grms. ligature silk, 50 suture pins. *Assistant-surgeons:* 1 knife for hoofs, 2 broad scalpels, 1 onkotome, Cowper's scissors, forceps, dissecting, 2 probes, 3 surgical needles, 2 grms. ligature silk, 50 suture pins. *Toilet-case:* 3 towels, 3 nail-brushes, 3 nail-cleansers, 3 tablets of disinfecting soap, 1 brass basin, 2 pitchers, 2 pieces of pumice-stone.

